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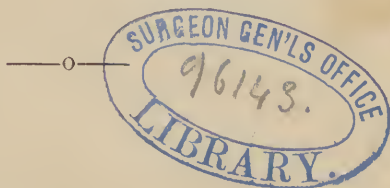
OF

A NEW WORK ON PHYSIOLOGY,

BY

✓  
W. H. TRIPLETT, M. D.,

WASHINGTON, D. C., U. S.



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## INTRODUCTORY.

We invite the human intellect to fresh inspection of Itself and of the Temple in which it dwells.

We speak only of Law and of Evidence.

An opinion is worth nothing if it have not law for its foundation.

Evidence is not entitled to confidence if it may not be inspected.

The mind is informed only through the senses, and comes to correct conclusions solely upon their testimony carefully taken, adjudicating matters upon law and evidence.



# LIFE.

## CHAPTER I.

### CARDINAL PRINCIPLES.

1st interrogatory. What is Life?

An Anatomical Basis operated by Physical Law,—this is life.

2nd interrogatory. What is the mode of the circulation of the juices which construct and sustain life's forms?

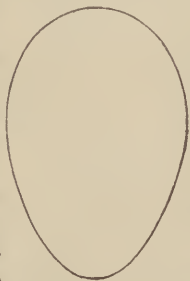
3d interrogatory. What is Life's Fundamental Form and Archetype?

4th interrogatory. What are the Terms of Independent Animal Existence?

5th interrogatory. What is Death?

Answer to interrogatory 2. The juices circulate in a vacuum, the arteries control the circulation of red blood, and as a consequence regulate vital phenomena.

Answer to interrogatory 3. Life's Fundamental Form and Archetype is an *Ellipse*, the big end up, the small end down, after the manner of the earth's orbit, or the solar ellipses, out of which it is evolved and eled. It stamps its duces, life's form doing grow to cardiac configuration, showing it in the shape of its shrubs, The higher the elevation the more cordiform its products. The apple tree and apple are of high cordiform type. The fauna exhibit it in their cordiform eggs and cordiform bodies; the measure of ascent in the scale of evolution being in exact proportion to degree of conformation to cardiac configuration. The body of animal life is fashioned over the model furnished in the central organ of the circulation Nature sets up in the first several days of the nutritive process, as miniature of life's great ellipse in the stellar circulation, the matrix of life's form.



*turns*

Answer to interrogatory 4. The ~~laws~~ of independent animal existence are in placental functions which have continuation and enlargement in the body mechanisms.

Answer to interrogatory 5. Death is reversal of the MOVEMENT of EVOLUTION, beginning always in the brain, with extension thence to the medulla bulb, thence to the heart itself. Life disappears through the temple it first constructs, sinking below the surface in the auricles. Organic change may render the organ incapable of performing its proper labor upon the circulation, and somatic death ensues. Nevertheless there is no infraction of the law, for cardiac action continues the most persistent. The outermost works, or border-land, are the first abandoned, as they are the last constructed. The intellect goes first; then respiration; then cardiac pulsation. The heart has ceased to fill up and strike against the chest-wall, but if the chest be opened it will be seen to continue its rhythmic movements some minutes later. Resuscitation is revival of the movement of evolution, commencing from the heart, with extension to the medulla bulb, thence to the cerebral cortex. The intellect is the last to revive.

Every one of these allegations rests upon an ANATOMICAL BASIS; or has support in well-known PHYSICAL LAW; or in DIRECT PHYSIOLOGICAL EXPERIMENTATIONS; or in CORROBORATIVE EVIDENCE, in vast amount in MEDICAL EXPERIENCE; in addition to the weighty circumstance, that heretofore UNANSWERABLE MEDICAL PROBLEMS have ready solution; being a degree of circumstantial evidence sufficient in itself to make conviction a moral certainty; BUT TAKEN ALTOGETHER, LEAVES NOT ROOM ENOUGH TO STAND AN INTERROGATION POINT UPON.

Before the intellect can perform work upon the darkness which besets it on every side, it needs to have clear appreciation of the tools it has to work with, and the nature of the obstruction which stands in front of it, inhibiting further advance. And it is necessary to have an enterprise clearly thought out, and a problem have formal statement upon the scientific slate, before a move be made upon the black border-land. The engineer must have suitable instruments, and firmness of footing; avoiding the morass of superstition; being always brave and vigilant. The proper preparation is the education of the senses. The intellect can only be informed in this manner. The greater number of the five senses he can

bring to bear upon the labor of inspection, the more highly qualified is the individual to perform effective work, and inform himself of the true relation of things in the environment out of which he is evolved, and of his own individuality, which occasions him so much solicitude and so much care. Would he know more of life?—he has instruction how to proceed to work. The animal body is a corporate mechanism of many smaller mechanisms. Set that fact down upon the slate. It is the first proposition of the vital problem. The body may be resolved into pieces of complete mechanisms, inter-dependent. It is a composite government; it is capable of still further resolution; it was evolved out of blood. There is written history of organization, and growth out of blood, in embryological tracing. There needs to be a scheme of construction and adjustment of means to the end sought to be attained. Where there is method there must be a scheme.

This is not all. It is a well-known fact, easy of demonstration, that vital phenomena, as well as nutritive processes, are dependent upon the circulation of the blood; hence it follows as a corollary that the manner of its generation, and the mode of its distribution, is matter of paramount inquiry; to have satisfactory answer made before Physiology may make forward movement into unknown territory of vital elaboration.

The manner of the circulation of the blood to be made out fully; and thorough appreciation of the mechanism had possession of by the mind: that formal statement may be made upon the slate; how blood circulates throughout the entire body? How it is regulated in the vascular apparatus, so that it may be turned on or turned off a part? Vital phenomena have explanation, in this circumstance. To put the interrogatories tersely: How do arteries and veins manage the circulation? And what great physical law has application to the vascular apparatus? These latter interrogatories to have conspicuous place upon the slate.

The law being specialized, it will be in order to go into the inquiry how the vascular tubing perform their work, in the necessary steps to carry out the law? To execute a law there must be power delegated to the vascular tubing of a high order. The time is come to set down other interrogatories upon the slate. How is an artery constructed? What are the anatomical constituents of an artery? Anatomical structure has definite meaning and ready interpretation given it. Muscular substance is Nature's preparation for producing MOTION

in animal mechanisms. Nerve ganglia, and nerve wire connecting them with muscular substance, is Nature's method for energizing it. This is the source of all voluntary and involuntary movement in animal mechanisms. The result is dependent upon the location and arrangement of the muscular substance. In the straight muscles condensation and shortening take place upon a line between their points of origin and insertion, flexion or extension being matter of location and leverage only. If, for example, muscular substance be upon the back of the arm, when it contracts under nerve stimulus there will be extension of the forearm. On the other hand, if it be upon the front of the arm there will be flexion of the forearm, upon condensation from nerve stimulus. If muscular substance be disposed in circular fibres, as happens in arterial and intestinal tubing, its condensation means diminution of the lumen of the vessel.

Before proceeding further it would be in order to return answer to these several interrogatories, as nothing can be done until proper answer be rendered. We formulate them in regular order, beginning from the initial point:

First, What physical law has application to the vascular apparatus for the circulation of blood?

Second, How do arteries and veins manage the circulation and carry out the law?

The answer to the first question is that blood circulates in a vacuum. By energizing muscular substance nature is enabled to form a vacuum, and by aid of atmospheric pressure which stands upon everything with great weight, she is enabled to force the surrounding juices into the excavation until the cavity be filled.

The great physical law upon which vital mechanisms have construction for the circulation of the juices is formation of vacuum areas, and the filling of the same by atmospheric pressure force. The auxiliary to the movement is in special magnetic force, known as chemical affinity, of especial service in plant life. In animal forms the chief means of transportation is formation of vacuum areas, and muscular energy constringing the contents in the rhythmic movement of aspiration. Speaking of magnetic force as auxiliary, water has strongest affinity for carbon, seeking it in the remotest branches of the tallest trees. It tears itself away from the powerful magnet of the earth to do this, supporting in its midst the soluble salts for the nutritive processes of the plant. ALL LIFE has con-



struction upon WATER, the highest forms having as much as three-fourths of their gross composition in this single element. The gray substance of the brain is eighty per cent. water and five decimal over. The lower the organization the less proportion of water there is in it. In animal structure cartilage has less than bone, the latter less than muscle, and muscle less than brain substance. The commerce of the tissues float upon the water of the circulation. In animal life this commerce has introduction into the body, and transportation through its hidden channels, by agency of atmospheric pressure force and formation of vacuum areas in front of it. There is no other mode to remove resistance and obviate friction. By such agency substances have importation into the body and expulsion from it. The lowest forms create a vacuum behind stomata when atmospheric pressure forces in the juice in which the microcosm swims until the cell is full. This is amoeboid movement. In the higher forms, as in the mammalian, the animal opens its mouth into water, then rarifies the air in the mouth cavity by withdrawing the oral air into the lung vacuum, made by descent of the diaphragm, in simultaneous and harmonious movement with the external performance, when atmospheric air presses the fluid into the excavation or unoccupied area. The importation of air is accomplished in the same manner. After water or other substance is in the mouth, the buccinators and dorsum of the tongue close around it in a species of systole, and push it beyond the isthmus of the fauces, where the movement to form the vacuum area is more simple. The vermicular motion of the intestinal tubing called "peristalsis," constituting such vacuum areas and succeeding systoles. The infant begins it at the breast. Tightly closing its lips around the nipple, it forms the vacuum in the mouth cavity, whilst atmospheric pressure standing over the mamma expresses the lactic juice into the unoccupied area. Imitation of the same process is the invention of the breast-pump. Cupping and leeching is enlarged application of the same principle as therapeutic device to relieve a part from congestion. The principle ever remains the same and cannot suffer change. There is variety in mechanical construction; that is all. The terms never suffer change. The infant gives indication at the breast HOW IT IS TO LIVE. The law for the importation of the juices into the body is the one for their transportation through the mechanisms.

Drinking is of more difficult performance in the quadruped

than in the man, since the former is necessitated to lift the water from the ground solely by aspiratory force, whereas in the latter the hand is made to do important service and the magnetic force of the earth (gravitation) overcome by that means. Still, after it is so raised to his lips, he would utterly fail in the effort to transport it to the inner side of his body but for the aid of aspiratory force in the mouth-cavity, which he must summon to his assistance. He must make a vacuum in the mouth-cavity before water can climb into it under atmospheric pressure force. He can lighten the labor of aspiration but is utterly unable to dispense with it. That he does so relieve it, let him make attempt to drink from the ground, especially if he be fat, and of impeded respiration. Being so afflicted, he has greatest difficulty in withdrawing the oral air into his lungs to form the vacuum in the mouth, since the voluminous abdominal viscera have such tight compression against the diaphragm from his weight upon them (as he lies upon his stomach) that the organ cannot force them down to make the vacuum in the lung cavity; so that when he opens his mouth into the streamlet, atmospheric pressure standing upon it accomplishes nothing for him with all its force. But his thirsty horse standing near lifts the fluid up the whole distance of the long axis of his head and neck; and his fellow-companion who is of spare build and free respiration is up in a few moments having filled himself quickly; the difference between him and them being entirely due to respiratory capacity with its qualifying power to form the oral vacuum. Fat men carry cups when they journey in the forrest. At each suck the diaphragm must descend else there will be no drinking.

If arteries are not manipulated by nerves it is in order to explain the following strange proceeding, viz.: The application of ice to an inflamed part. (The manner it stops hemorrhage is the manner it stops inflammation.) The application of external heat in pneumonia and peritonitis and other deep inflammation. The application of a blister over the sacrum or hypogastric region in visceral disease located in the pelvic basin. Why cup the loins or irritate them in renal congestion? What are you doing with these agents? Take example of the chest region, the skin, superficial fascia, pectoral muscles, costal bones, and pleural lining, are interposed between them and the lungs. Moreover, after penetrating this barrier, you come down upon the plural cavity, the lung having no connection



with the walls unless pleuritic invasion have had such effect upon them. If such prompt relief, as frequently happens after such procedure, be not due to impression made upon the sensory nerves of the part, thence reflected to the spinal medulla, and the DOUBLE ROW OF GANGLIA along the dorsal column having CONTROL OF THE DEEP VASCULAR TERRITORY, (in this instance the posterior pulmonary plexus, thence to the pulmonary vascular apparatus,) it would be in order to furnish other explanation and make us intelligent upon this point. We await answer. It is a matter of importance. In the chapters on the circulation of arterial and of venous blood, special nerve territory has consideration, with tabulation of numerous physiological experimentations. Spinal nerves have special vascular territory, and the circulation may at any time be influenced through them, and blood turned on or turned off a part, according to the energy of nerve stimulation. If the spinal medulla be destroyed up to the sixth dorsal vertebra the animal will die in twenty-four hours of brain anemia, the paralyzed abdominal apparatus holding nearly all the blood in the body.

In the chapter on the circulation of the blood anatomical and physiological data in great abundance have full exhibition to confirm the statement that the entire vascular apparatus, inclusive of intestinal, venous, lymphatic, air, and arterial tubing, are composed of a vast series of tubular hearts, possessing the power in great or less degree to aspirate liquids into their cavities, and to expel them again in rhythmic movement.

In the chapter upon the Placenta, evidence anatomical and physiological is given to prove that the intestine is only a great venous tube, and analogue to the tortuous venous sinuses under the placenta, but instead of blood contains chyle, out of which the villi of the independent animal make selection of nutrient constituents, turning them into the radicals of the portal vein (the new umbilical vein) of the independent animal, as placental villi do, from the venous sinuses underneath it. This could not always continue, and larger preparation for a larger environment had to be made in advance of the change; hence such great analogue. For the present we defer further description. We claim it to be muscular tubing, with power to fill and empty itself, in a series of cardiac territories of limited extent, which actively expand and actively contract under the stimulus of their contents. This is the meaning of "peristalsis."

Muscular substance, and ganglionic nerves to energize it, are the two great factors to all the vascular apparatus for the importation and quick transportation of the juices. There is no exception. Physical law is no pent-up Utica, but has universal application and extension over the entire class of animal mechanisms.

By muscular force solid substances are caught by the incisors and cut in twain; by muscular force is triturated between the grinders and insalivated. After this it is pushed beyond the isthmus of the fauces, where it is passed down the œsophagean escarpment to the dilated portion of the intestinal tube for further reduction and preparation, and by active muscular expansion and contraction is passed along a complete cardiac chain, forming the intestinal tubing. Such active expansions being necessary to guard the delicate epithelium, and ward off traction force and incision of hard substances from the highly organized and delicate villi, which would otherwise be unavoidable. Serious detriment would result with arrest of function if intestinal contents had to force a passage by severe constricting movement only. There can be but one opinion upon this subject. It would be a bad plan. Nature never adopts a bad method. It is therefore not the true one—she promotes the best. Arrest of this movement is constipation; it is ganglionic lesion. Cathartics are substances which stimulate these ganglia.

What remains for solution at the present stage of inquiry is: How are arteries constructed, and what their anatomical composition? The former requires consultation of embryological evolution. Arteries are made in sections of distinct pieces, and have construction and elaboration, as the heart is being built and elaborated, and finished when it is completed in simultaneous action, the separate pieces having connections made from time to time, like a lengthening train of cars, till at length the whole is complete in one harmonious line of arterial tubing, when blood may pass over continuous conduits. But the circumstance must be ever borne in mind that they were made independent of the heart, doing their own work of self-construction as the former was building up itself. Having such high prerogative at life's beginning, it may well be supposed Nature does not intend **TO TAKE AWAY THEIR INDIVIDUALITY** when she links them together in a continuous line, to act in concert, as a file of soldiers, for the common good, the whole army of hearts being under one system

of government, and acting with the central organ of the circulation. When one cardiac territory falls out, (indicated by ganglia in the muscular walls,) there is interruption of the circulation at that point. In other words, to use old terminology, there is "congestion" in the part. The matter has full consideration in the chapter on the circulation. The anatomical composition of an artery is the same as that for the heart, the modification being only in difference of arrangement and in size. But when amount of tissue in the two has full consideration, the gross amount of arterial structure is fully fifty times greater than the central organ. Each has three coats or tunics—an internal, smooth, non-vascular one. In the former it is called the "intima," in the latter, the "endo-cardium." The heart has a powerful muscular tunic, so have the arteries. The arterioles are more than half muscular substance. Lastly, the heart has a strong fibrous envelope, to limit dilatation; the arteries have their strong fibrous adventitia, to limit dilatation in their walls also. The heart has sympathetic ganglia in its muscular substance, and plexuses of nerves upon it. The arteries have special sympathetic ganglia in their muscular substance, whilst the external wall is literally covered over with nerve plexuses. The heart has communication with the cerebro-spinal axis through the par vagum. The double chain of spinal ganglia of the sympathetic have each two roots of connection with the spinal cord; the sympathetic nerve has most intimate union with the cerebro-spinal axis. It is a matter of demonstration, the entire vascular tubing is under control of sentient nerves; that they contract and expand under appropriate stimulus. Blood is turned on or turned off a part by arterial behavior only, in response to special stimulus.

The hæmic hydraulics is under control and is manipulated by the arterial tubing, through cardiac ganglia resident in their walls. Condensation of its muscular substance means anemia of the part, and if it continues over long, there will be necrosis of the bleached part, as in ergotism from spurred rye. Relaxation, or paresis of its muscular substance is followed by congestion and disturbance of the circulation in the affected locality.

Nutrition and vital phenomena have regulation by the vascular apparatus. The import of two most important medical terms—anemia and hyperemia—may now be given, and true explanation rendered to a vast deal of important symptomatology.

It is a matter of great moment that the entire vascular apparatus, more especially the arteries and intestines, are under influence of sentient nerves of the skin. For example, the great weakness coming on in sea bathing is due to cerebral anemia, from condensation of cephalic arterial tubing and the deep vascular territory of the trunk, with consequent transfer of arterial blood to the body surface. If it go too far, syncope will be produced, so great is the alteration in hæmic hydraulics, with excess of blood diversion from the brain substance to the body superifice. The sudden desire to pass water, or fecal matter (if any be present in those receptacles,) is measure of amount of condensation in the intestinal tubing or walls of the bladder, the whole being under one system of government, and connected with the skin surface through the double row of dorsal and lumbar ganglia, extending the entire length of the spinal column. An impression made over the sentient nerves of a part has immediate report made to these telegraphic stations, and radiates at once over all the immediate visceral connexions.

The common practice of relieving infantile colic by placing the little sufferer in hot water, has ready explanation. Hot baths operate by causing condensation in the deep vascular territory, including the large venous tube of the intestines and bladder, etc., the fluids having expulsion to the external surface, excementitious matters being driven through the sphincters and blood into the skin capillaries. If it be pushed too far, syncope will result; if further than this still, death will ensue from deep bleaching of the brain substance. In this manner an animal may be bled to death without loss of one drop of blood from the vascular apparatus. On the other hand, local bleaching in vital parts may be suddenly induced by NERVINES or by TRAUMATIC INJURY. Chloroform kills by inducing, 1st, CEREBRAL ANEMIA (unconsciousness;) 2d, by inducing BASILAR ANEMIA, with consequent arrest of respiration. Syncope is basilar anemia of short duration, the heart not filling up and striking the chest wall as usual, yet it still continues its rhythmic movements; and if the left chest be opened, they may be seen to continue for some minutes later. It is the same case in death from a blow or gunshot injury to the brain. Death always occurs from BASILAR ANEMIA. This subject has full consideration in the chapter upon the functions of the sympathetic nerve, with abundant physiological experimentations to confirm the state-



ment, "that death is always from basilar anemia," the heart being the last organ to suspend its movements.

When ganglionic lesion takes place in an artery the result is congestion. The essential factor being the circular muscular substance is not energized by appellate nerve ganglia, with arrest of active expansion and contraction. Cure is effected by stimulation of the ganglia. Application of cold or other suitable stimulant to the nerve-arc supplying the affected walls is preferable to all other methods when direct application is impossible. Medicated blood has arrest in a paralyzed artery and stimulates it, when it condenses itself. It passes too rapidly over sound arteries to affect them.

In respect to other matter. **THE BLOOD and ALL THE JUICES CIRCULATE IN A VACUUM.** The advantage is too apparent to require argument to show its great utility. It may be mentioned cursorily that it does away with the necessity of a mighty central cardiac force, as now obtains, a fraction of such force being all that is necessary to the performance of the circulation. The arteries and arterioles aspirate blood by active dilatation. The corpuscles are saved the rudeness of distension force upon the walls of the arteries to make a roadway for them into the tissues, not to mention the circumstance of enormous atmospheric pressure to be overcome by the central engine, since it is all outside the arteries, upon the base of the pyramid, and would have to be overcome before blood could run under it. The corpuscles would go to pieces at once if such thing could be attempted. Nature does not place such burden upon the heart; on the contrary, each artery and arteriole lifts up the air that stands upon itself, acting simultaneously and in universal accord, as a vast army of well-trained soldiery. They move in unison for the common good. The blood therefore performs no rude labor and sustains no shock beyond what is necessary to lift it through a vacuum.

It has ceased to be impossible to give explanation of continuance of arterial circulation, after an aneurisinal mountain has risen up in the road-way of the blood, especially in instances of enormous thoracic aneurism. In such condition the muscular substance of the heart is frequently atrophied. According to the law of muscular development, this is the opposite of what should happen, predicated upon the statement that the labor of carrying on the circulation is performed by the heart. Hypertrophy of that organ means imperfection of its valves and measure of such organic change.

Symptomatology has fresh interpretation. The condition indicated by "shock," the most difficult term in medicine to define, (and never has been,) is rendered transparent under the white light of physical law. It is a sudden condensation of arterial tubing through encephalic territory. **MENTAL MOTION** or traumatic injury is exciting cause. It is **DEEP BLEACHING OF THE BRAIN SUBSTANCE FROM ARREST OF ARTERIAL FLOW** from quick diminution of the lumen of the vessels. A powerful systole has been excited in the arterial walls and blood inhibited from the natural channels. The internal carotids, for example, have not near their size, their walls being so energetically condensed under stimulation of nerve wires focused upon them through the carotid plexuses. Some females have very flexible and excitable carotids, condensing them on the slightest occasion. A sight of blood will make them faint. Mental motion is excessive in them from this cause. They are very emotional, because arterial blood is subject to irregular distribution from lack of uniformity in arterial behavior, and are often "giddy" from sudden brain anemia. The generative apparatus is most potential cause of vascular disturbance in them, robbing the cortical portions of the cerebrum, by sudden springing open of arterial mains in the pelvic organs and abdominal viscera. Women who grow "nervous" have need **TO CONDENSE THIS DILATED VASCULAR APPARATUS** and **SEND MORE BLOOD TO THE BRAIN**. Sponging the body surface with cold salt water, especially the dorsal region, will send the blood back into its channels. **THE DOUBLE ROW OF DORSAL and LUMBAR GANGLIA ARE CENTRES OF NERVE ARCS TO ALL THIS APPARATUS—ONE END BEING UPON THE SKIN, THE OTHER UPON THE VASCULAR WALLS.** An impression made upon the skin surface has immediate reflection upon the arterial, venous and intestinal territories. If cold water is not successful, let warm water and salt be substituted.

That hundred-headed hydra "Hysteria" may have intelligent inspection, and be looked through and through. Hæmic hydraulics is tampered with, and blood has irregular distribution in consequence. Convulsion is the result of over-vascularity of the base of the brain and spinal cord. Coma is Anemia of the Cerebral Cortex. Delirium is the product of Irregular Vascularity of the Cerebral Cortex.

The hard wiry pulse of extensive peritonitis has ready ex-

planation. Nearly all the blood in the systemic circulation is in the abdominal organs, and in order to keep the brain supplied the arterial tubing condenses itself upon the remnant to propel it along, and give them control of what is left. The arteries become hard as wire in consequence of **EXTREME DEGREE OF CONDENSATION**, the arterial lumen shrinking in a ratio with the contained current. The whole vascular apparatus (outside of the abdomen **WHICH IS PARALYZED**) is under tribute to the brain. The red corpuscles are sent to it as long as there are any to send. The **RIGOR MORTIS** irons out everything; the last systole of the ventricle (now relaxed;) the last systole of the arterial tubing (now also relaxed;) the wiry radials are gone with the last systole of the arterioles, and nothing is left in their open lumen of what the arteries had been during life; not so much as a vestige of the tragic end remaining. The Left Ventricle is **EMPTY**; the Arteries are **EMPTY**. Is it Coincidence only, or correspondence of function? Do not arteries contract upon blood as well as the heart? What is the hindrance? Hindrance—the word is in Medical Imagination, not in anatomical construction, for this looks all the other way.

Take up the slate and write this upon it—**THE AUTONOMY OF ARTERIES.**

\* \* \* \* \*

**THE MODE OF MOTION IN THE TRUNK** is the same as that for the vascular walls. It is susceptible of demonstration that it expands and contracts rhythmically, having an interval of rest, after the manner of cardiac movement.

Respiration is a circulation and pulsation of the trunk of animal life—**THE PLACENTAL SOUFFLE OF THE INDEPENDENT ANIMAL**—the number of such movements or pulsations being sixteen per minute. It is the number of miles life travels per minute by the axial movement of the earth.

It is a matter of demonstration that increase of this movement is the essential factor of fever. The thermometer test applied before and after vigorous lung performance in a set of vocalists is an *experimentum crucis*. After an hour's exercise increase of temperature is in exact proportion to lung exertion and lung capacity.

It is a matter of surpassing interest that respiratory performance may have influence from external nerves. The intercostals are motor and sensory, administering to all the external walls, and when irritated by scald, or specific poison of the

exanthemata, hurry respiratory movement by reflex action upon the spinal medulla, with extension to the phrenics and pneumogastrics. The danger is in proportion to extent of surface involved and duration of the irritation.

Death from scald and death from small-pox or scarlet fever is the same vital performance, and is the result of excessive blood temperature, causing great restlessness, delirium, coma, and finally suspension of respiration.

To revive respiratory movement the head should be lowered. To re-awaken it the trunk should be inverted and rhythmical compression made around the walls, with powerful stimulation of the skin-surface, including castigation, the object being to facilitate arterial flow to the medulla and medulla bulb, the vascular ganglionic centres having impression made upon them over nerve arcs terminating upon the skin.

The pulmonary organs are for importation of oxygen. Increase of respiratory movement means increase of blood temperature (if it be not physiological compensation for diminished lung area.) The formula is simple for the regulation of blood temperature. **REGULATE RESPIRATION.** To reduce fever, **INCREASE THE SURFACE EVAPORATION.**

Sponging the naked body (in extreme cases) with tepid water, with free ventilation, will accomplish speedy reduction of body temperature. Fanning expedites surface evaporation. 'Tis Nature's method for absorption of heat. Create currents of air over the moist body from tepid bathing.

To reduce respiratory movement **INDUCE SLEEP** by full doses of chloral, when blood temperature will admit narcosis. Respiration falls during sleep to almost normal rate of speed; temperature falls in consequence. Surface evaporation to have regulation by the thermometer. Sleep to follow reduction of temperature. Increase of respiratory movement will be persistent in degree to duration of exciting cause. Invasion of low organisms speedily subsides—they soon perish. In protracted fever local lesions, set up by the microcosm, keep up respiratory movement; local lesion to have regulation through the vascular apparatus by reflex stimulation through nerve arcs terminating upon the external surface. The chief danger in fever is excessive blood temperature. The office of therapeutics, to regulate temperature and respiratory movement. Local irritation hurries respiratory movement. Gastric fever results from irritation of the par vagum and trisplanchnic nerves, reflected upon the spinal medulla and medulla bulb.



## CHAPTER II.

### LIFE'S FUNDAMENTAL FORM AND ARCHETYPE.

All substances have FORM; it is visible evidence of ORDER. Life has appropriate form in harmony with universal behavior. The viscera in animal forms have definite shape, and perpetuity throughout all time, in all portions of the globe. The law applies to the body or trunk in which they have suspension; otherwise definite forms have embrace in an indefinite form. Such proposition is remarkable and monstrous.

THERE IS DEFINITE SHAPE TO THE BODY OF PLANT AND ANIMAL LIFE.



IT IS IN HARMONY WITH UNIVERSAL ORDER, AND PUBLISHED THROUGHOUT THE FLORA AND THE FAUNA.

LIFE'S FUNDAMENTAL FORM AND ARCHETYPE IS AN OVOID.

Polar force organizes matter into form by crystallization. On a cold morning it is seen in its lowest type in the beautiful archetypal miniatures cast upon window-plates, of frost-ferns, frost-leaflets, arbor-vitæ, etc., from a moist atmosphere of a "living room." These beautiful archetypes of plant life are resolvable into minute atoms.

Matter crystallizes into a sphere, as the lowest expression of life's form. It is earliest effort to organize life into vital government. The earth is globular from magnetic force; so is the cryptogamic cell from prevalence of the same law. From this point life's form grows up into an ELLIPSE, making progressive stages of ascent, and leaving record of progress in incomplete forms. The ellipse is the line of momentum of planetary spheres—the pathway of the stellar circulation. The impetus of this momentum is pulsated through matter, which being free to move under guidance, under all-pervading magnetic

force, swings into the line of march with universal order and discipline. All moving bodies circumscribe elliptical configuration as the foot-path of their momentum. It is the mode of motion of the solar circulation.

The large end of the earth's orbit is up, the small end down.

The flora hold up this configuration in their highest products. The more advanced the growth, the more elliptical or cordiform the fruit, the leaflets, and the tree itself.

The apple tree is a beautiful example. It is the highest product of the flora. Its broad base and cone-like apex has renewal in its cordiform leaflets, whilst the highest product of the tree, the apple itself, is of high archetypal form; and its very seeds have growth in this direction, as indicated in their wide upper end tapering to conical apex below.

It is true of all the higher fruits—the cherry, the peach, apricot, plumb, strawberry, etc., etc., etc.

The rosebud is highest flower, whilst its broad base, with gently sloping sides to form the beautiful conical apex, is miniature of the great ellipse out of which it is evolved and over which it has such faithful mould. A tree is of rosebud shape, whilst a forest is vast bouquet of rosebuds.

As example of persistence of ovoidal type in the fauna, domestic fowls may be taken as ready to our hand. Look from the rosebud to the egg of the hen. Is their very close resemblance in configuration accidental? Are not all rosebuds ovoidal, and all high fowl and all their eggs of rosebud shape? The partridge is a very high bird. Its eggs are of rosebud configuration. In scarcely more time than one revolution of the earth upon its axis after commencement of incubation, if the egg be opened and the yolk inspected, another smaller ellipse may be seen, a miniature of the egg in which it is born. The heart is centre of an ovoidal body yet in embryo; but, when complete, and ready to break its shell, will be still higher animal form. The prominent breast and tapering hinder parts is maintenance of cordiform configuration—a nest of three eggs, before the marble temple be broken and the chick escape. Take the dog, as example of the quadruped. Its head is ovoidal. After removal of the head and extremities, inclusive of all the hip muscles down to the iliac bones, (since these have reference entirely to the crural appendage,) the remainder will be cordiform, or a broad fore part and a conical hinder part. The head of the horse is ovoidal; so his eyes. The body is of high archetypal form. One need only direct atten-

tion to the quadruped in confirmation of all-pervading law. They are all cordiform.

Man is consummation of cardiac growth, his body being a perfect heart. After similar removal of the extremities and ovoidal head, with the rosebud eyes on the stamen of the optic nerve, what remains is clear outline of the heart in his bosom, the little prototype Nature sets up in the centre of the blood circulation in the early hours of foetal elaboration. After formulation of the terms of independent animal existence, it will be in order to regard the circumstances in detail of Anatomical Construction and Mode of Motion, in the body of animal life and its prototype. How do they agree?

Seeing the persistence of cardiac form in the flora and fauna, it is a matter of great interest to discover the connecting links in the chain of ascent from vegetable to animal forms. It may be done quite readily. In terrestrial environment they exist in the hollow worms, which subsequently become insects in great variety, representing different stages of cardiac growth. They are all ellipsoidal. In water environment it is still the same—variety being degree and measure of development only.

Fish configuration is ellipsoidal. Ocean shell have similar contour. The Nipadites Umbonatus and CONCH is beautiful carnation rosebud wrought in living marble. Nature perpetuates her image in sea and land upon life's form and on the very marble in which it may encase itself or erect within the temple.

Skeletons are ellipsoidal. Examine the diagram of a transverse section of the human body above the heart. Is not the general outline that of an apple? The spinous process is stem—the breast-bone is representation of the lower part or blossom. The heart in its capsule is the seed in its envelope and origin of the tree, the source of all growth. The body is built up out of it and over it. It resembles a rosebud hanging by vascular rootlets.

Territorial acquisition is in cephalic and pedal extremities, elaborating them now more rapidly, now more slowly, according to environment and means of doing so.

The lumbricoids are first stage of cardiac growth. They are tubular hearts, having circular and longitudinal muscular substance, with which they contract and elongate their bodies, or expand their hollow cavities to form a vacuum, and aspirate themselves full of juice, living independent of every other appurtenance till the time of metamorphosis—a tubular heart,

feeding itself and sustaining existence by itself. The "grub" is yet higher growth, almost ovoidal or cordiform. When it contracts its longitudinal fibres it is cordiform. The body of the butterfly, of which it becomes the chrysalis, is still higher form, whilst its egg is later growth toward cardiac configuration. The chrysalis itself is ovoidal.

The body of a fly is cordiform. It is perfect in the humble bee. The head of either is complete configuration of the great archetype.

The fresh water frog is example of speed of elaboration. Beginning with an egg, it journeys by rapid metamorphosis till it can set up almost human-like, and the pedestals with their five terminal digits before and behind, the abdominal breathing, erect head, and great conscious eyes, present a picture remarkably near to what is accomplished in uterine gestation in the human species in two hundred and eight days, the difference of time being due to the slow evolution of brain substance. It is the slowest evolved, and delays gestation.

In water environment, cardiac evolution has many phases, different degrees of growth being observable. The leech is a water lumbricord, and can aspirate quite vigorously.

If one seek for connecting links they may be found in countless numbers.

The "Medusa" is ovoidal or cordiform—a large heart swimming by itself and feeding on the juices of the sea. They swarm in tide-water.

The scale of cardiac ascent, from the simplest to the highest forms of animal existence, in sea or land, is quite long indeed. The walrus and the whale in the former, man and the elephant in the latter, are consummation of the highest form possible to the environment.

And in the pregnant woman there is miniature of it all in embryological elaboration of the ovoidal embryo; with the ovoidal heart in its midst, as its archetypal form, the ovoidal uterus, and lastly, the ovoidal ventricle in the abdomen itself, the base at the diaphragm, the apex in the pelvic excavation; a nest of four eggs instead of three, as in the case of the chick within the egg. Most wonderful of all, the record of the journey is kept in embryological tracings, beginning with the cell and progressing to conclusion.

## EVOLUTION.

Before taking up the matter of the terms of independent animal existence, it is our duty, as also an impulse of our mind, to follow Evolution to its present terminus. Science would account for all forms of growth and all vital phenomena through operation of great physical laws.

**EVOLUTION IS TRUE.** For confirmation of the statement let the intellect look upon its environment—then upon the temple in which it dwells—then upon its own behavior—and from that standpoint of observation regard stellar space attentively. Man is what he is because he is where he is. He is organized out of matter which is rocked in the cradle of the spheres. He is evolved within the environment of the stellar mechanism and participating in all its movements. He is travelling at vast rate of speed, the momentum is enormous. That attention is called to the circumstance will the rational mind contend for one moment that it is not affected by the tremendous momentum? Will it deny that a vast moving mechanism containing a small one has no effect upon the latter? It cannot do so and retain its self-respect, the highest loyalty in the universe and most just homage to virtue. It is not sufficiently informed, else some hidden motive in the morass of prejudice and superstition swerves it from the lofty path of knowledge, to follow the ignis fatuus of dark tradition into a hopeless past. Whether it do so or no is matter for itself. This is a law that will live regardless of his behavior—*that which rides upon a mechanism shares its momentum.*

From want of experience (his attention not having been directed to it) is he inclined to put in objection? Let him propose to jump from a railroad train at fast rate of speed—sixty miles an hour—would any one follow the suicide? If it is irrational to make such jump, it follows as a necessary corollary it is equally irrational to make remark that momentum is a trivial circumstance. Take the slate and write this interrogatory upon it—**WHERE AM I?** Science makes answer—You are upon a planet in the heliocentric system, riding at a vast rate of speed. The earth is twenty-five thousand miles in circumference. This entire journey is accomplished in twenty-four hours, else there would not be alternation of day and night. At a given point upon the globe Life's Form travels 1,000 miles an hour,  $16\frac{2}{3}$  miles a minute. At such rate of speed matter takes the shape of a sphere under magnetic force which holds it fast.



This is not all ; there remains the still greater momentum of the pathway of the earth's orbit for consideration. It makes an annual revolution around the sun. The enormous distance and necessary rate of speed to traverse the millions of miles through space startle the intellect. The earth has a radius of 8,000 miles. At a given point Life's Form is at the end of the radius of a vast wheel of that extent, revolving at the rate of one thousand miles per hour, and moving over an ellipse perpendicular to the radius at still faster rate of speed. It is a spiral motion. Life's form is propelled through a screw at enormous rate of speed. Is it a matter of wonder there are whirlwinds when atmospheric conditions are suitable?

Take smaller example. If a man place himself in the mechanism of a mill he is lost, for its momentum is so great that traction force will tear him limb from limb, and further reduce the shapeless mass into a bloody fluid. Physical law pulverizes him into a juice.

Man is born within the solar mechanism, a motion within a motion. What is the result? Let him look into stellar space attentively, then into himself and into his life. Look at the shape of his heart.

The central organ of the circulation holds up ellipsoidal configuration. Look from it to stellar space for interpretation of elliptic form. There is other information. There are seven pencils of light ; are they accidental? There are a number of atmospheric envelopes of volatilized metals around the sun, the source of these rays. This matter has extension : There are seven cortical layers to the earth, seven cortical layers to vegetable forms in each annual ring, seven cortical layers to animal forms with extension all through the mechanism ; seven layers to dermic follicles ; seven cortical layers to the muscular envelope of the body ; seven cortical layers to the heart ; seven to the stomach, seven to the bladder, seven to the womb and EVERY HOLLOW ORGAN.

The matter does not rest here : Vital phenomena are **PRODUCT OF PHYSICAL CONSTRUCTION**—a spring flowing out of the organic form. Vital performance cannot rise higher than its source, and a mechanism may be known **BY ITS DEEDS**. Man performs great or little things in proportion to cerebral development ; he cannot exceed it. This is not all, for he is in the works of a tremendous mechanism, whirled through space at enormous rate of speed, and **THROB-BING PLANETARY MOTION** through mental movement.

He is part and parcel of ALL THERE IS, and miniature of it all. The seven cortical layers which pervade his organic form, shadow themselves in the grouping of layers of seven days to form a week, his earliest notation of time, whilst progress in elaboration enabled him at last by terrestrial measurement and terrestrial movement to measure time by a rising scale of consciousness, of the line of momentum of the vast mechanism, to record time by seconds, minutes, hours, days, weeks, months, years—the month having reference to lunar movement, the remainder to terrestrial behavior. The axial movement, with a succession of day and night, produce corresponding effects upon him, represented in sleeping and waking. Animal life subsides in darkness.

His forms of government are perpetuation of the rhythmic movement in which he is swept along, showing increasing conformity the higher the scale of ascent. Central solar force has representation in the organic law or constitution of government, with impersonation of the same in the chief presiding officer, or Magistrate, or King, as the case may be. The seven cabinet officers are persistence of the seven cortical layers; the seven chief justices is further expression of the momentum of this organic force. The relegation of social misadjustment to twelve individuals in a jury has vast analogue in the conservation of the planetary movement through influence of the Zodiac. The rule of arbitration in the selection of three men is evolved out of the potential law of the universe. Three forces dominate all there is. Republican form of government would seem to be the highest type, since life's highest form is left free to move through its own ellipse without prejudice. Nevertheless, monarchical government shall be needed for considerable time ere sufficient numbers will have been entitled to hold the reins by higher evolution. A constitutional monarchy is high order of government.

In his very diseases man exhibits further conformity to all-pervading physical law. The seventh day recurrence of ague after subsidence of quotidian. The seventh day recurrence, else exacerbation, of remittent fever. Fever continues in multiples of seven. The 7, 14 or 21 days of typhoid fever are cases in point. Not to continue the matter further at present, we would respectfully commend it to scientists, more particularly to students of astronomy, suggesting that life's ellipse, especially that of the circulation of the blood, have careful inspection, since the child of space needs to sustain resemblance

to the mother that gives it birth and supports it in its little circle of activities.

Whence all the order and cohesion of government, the visible evidence of all-pervading law, holding lowest species of animal life together in harmony, having highest definition in man, if it be not momentum of the vast mechanism in which life's form dwells, transmitted over wires that regulate its movements?

There is such a thing as MOTION UNDERSTANDING ITSELF. Life is conscious movement pervading a mechanism. Man elects his food, thrilling with the sensations occasioned by it when passing his lips. Nor does it end here, for he rolls the sweet morsel in his mouth; he is happy with the sensations it provokes. He does even more than this; he looks into his own mechanism, watching its motion, even his own thoughts. He has inspiration as product of high momentum of thought. He is coming to an understanding with himself, knowing a vast deal more than he did how the matter stands between him and Nature, looking into stellar space fearlessly, full of unspeakable affection.

Passing allusion is made to the wonderful corpuscles swimming on the waters of the circulation over the circuit of the blood, and comparison drawn to stellar circulation around the great ellipses in the heavens, whilst man, a miniature of it all, rides through space on something larger than a corpuscle.

Solar heat is the cardiac force to the blood circulation by energizing muscular substance in the walls of the vascular apparatus.

If animal life be miniature of the heliocentric system, as is apparent, the cardiac force to the stellar circulation is also solar heat, gravitation remaining as other name for all-pervading magnetic force.

Gravitation is name for other thing than it is. It is misnomer for Magnetic Force, otherwise it is without place in the solar system, is isolated and alone in a universe of affection, opposing everything, appropriating everything—Enormous—Unnatural—Solitary—Monstrous—Selfish—gulping the universe down its prodigious gullet. It served useful purpose (early forms ever do) to give place to better growth and higher knowledge of dominant potentialities of the stellar circulation. It was far-reaching thought of a great intellect, disposing of the difficulty of planetary space for that time. Intellectual night is yielding under solar force. Gravitation is pass-



ing away upon its clouds. Gravitation needs reconstruction and fresh interpretation. There is misadjustment here.

The earth is a great magnet. Everything terrestrial moves toward it when resistance is taken off; but there is special magnetic force in its component parts which cause them to assume close and intimate relation, called chemical affinity. When a tree is cut through, magnetic force pulls it speedily to the ground, where special magnetic force dissolves it, the air greatly assisting in the work, whilst water exports its alkaline earths and minerals. Finally it is resolved back into original elements. Water is the great solvent and organizer of the earth, going down into innermost depths to oxydize the metals and to dissolve them, after facilitating certain combinations in the formation of the numerous salts. What is left after these affinities have been satisfied serves as a means of transportation to this hidden commerce, bringing it to the external world for the construction of plant life and animal forms. The work is going on all the time. Water that escapes at the foot of a mountain is the juice of the mountain, and that which escapes from the earth is the juice of the earth. It is a most potential organizer. At the present time the Burning Spring, at Niagara Falls, is more luminous than ever before in the memory of the present generation. It is Sulphuretted Hydrogen Gas. The explanation is simple. The season has been an unprecedented rainy one. Water has penetrated the rocky strata deeper than usual, and in larger quantity. Oxygen comes across a stronger affinity than it has in Hydrogen, and marries at once some powerful metal, whilst Hydrogen weds with sulphur, becoming a luminous gas. Nature looks upward through the affections, climbing higher and higher, ever moving onward and upward, till life's highest form be reached. There is no such thing as "inorganic chemistry." It is all organic, the difference being only one of degree. **THERE IS NO CONFLICT IN NATURE.** There is commotion of elements falling into line to form closer union; there is co-operation and concert of action, and formation of higher products. Divorcements take place to effect higher and better union.

Water, air and earth have construction into plant life by agency of solar force. Trees grow to a prodigious height—in California as much as 340 feet. In all that labor of construction there is no conflict. Water transports the salts it generates in the earth into the capillary spaces of the tree, drawn onward and upward by the powerful affinity water has for

carbon, the chief constituent of the tree. It hunts up carbon eagerly. In a vacuum it will rush up through the interstices of sugar with great rapidity. When the tree is cut through it falls upon the bosom that gave it birth and nourished it. No conflict anywhere. On the contrary, there is mutual love and undying affinity everywhere.

Take other example. Water falling upon the Rocky Mountain chain perforates to deep recesses in its sides, and, after saturation of the earth, making numerous details for the labor of organization, what is left escapes at the foot of the chain and becomes A WANDERER, going oceanward. It satisfies the affinities in the earth; the remainder starts out on a pilgrimage. Some of the water of the Mississippi river wanders nearly 2,000 miles before it reaches the Gulf of Mexico; even then it wanders onward to the ocean, and belts the globe itself. Where is Central Force, that it does not sit heavily upon it, and stop it in all this journey? It moves over hill and plane—on, and on—ever onward—always moving—moving. It never stops. Where is Gravitation force, that the roaming vagabond may undergo arrest, and have estoppel of this unceasing marching—marching—marching? Follow it to the sea-shore; no rest—no quiet subsidence and gentle submission to Central Force, but an unceasing, never-ending movement of the waters breaking upon the beach, now more rapidly, now more slowly, under Magnetic force emanating from the lunar orb. Study the history of the river. Is it not torn from the bosom of the ocean by solar force through vast surface evaporation, and the clouds driven landward by the same power, partly through magnetic force of the earth itself? What is left unprovided for in the earth seeks speedy return to the great magnet from which it had been removed some days and weeks previously, big end forward in this great fluent magnetic needle. It is the law of the magnetic needle.

If a mountain spring up in the roadway it will tear it down in frantic efforts to get back home. Harper's Ferry is ready witness, as also the Natural Bridge, in the Blue Ridge chain. The Whirlpool below Niagara Falls is eloquent witness that water will hew out a channel through the hardest stone, in order to make more expeditious journey to the great Magnet from which it had suffered temporary removal. At this point it abandoned an old road-bed of 17 miles in length for a new one of only 11 miles, in a quite different direction. If the metals are slow and tardy of solution, water runs over and

around the side of the mountain at first but the work of mining and excavating never ceases till more expeditious roadway is complete. Nothing is lost; out of the hard resisting mountain the soft seed-bed of the river deltas is formed.

This is not all that water performs. Life's form which comes up out of the earth—life's forms everywhere are constructed upon water. Three-fourths water are the terms for highest products. **LIFE REARS ITS TEMPLES UPON A SEA.**

Important circumstances concerning animal life have ready explanation given them, for animal life is under magnetic force.

Gravitation cannot be shown to exist; magnetic force may at any time.

Why is it such difficult matter to walk? **IT IS THE MOTION OF A SMALL MAGNET OVER A GREAT ONE.** The magnetic attraction of the earth is enormous, and but for **OUTSIDE POWER OF SOLAR FORCE** there would not be motion upon the earth. If blood temperature should fall but only one degree from  $98\frac{1}{2}$  to  $97\frac{1}{2}$ , man cannot walk; if one degree below this he perishes. The essential factor of his movements is Solar Heat. Mental motion has similar arrest.

What it evolves flows out of the same inexhaustible source, and when man is dead solar force re-arranges his elements. Not a temple in the earth, not so much as a stone is built in the absence of this all-pervading power. All rain would cease and air be still as death. Instinct is magnetic force.

The brain and spinal cord constitute a great magnetic needle, supported on movable stilts.

For illustration, let a dog, cat, or pig suffer removal from home to a considerable distance. Notice the result. The needle gets up at once on movable stilts, straightens out, whirls round to the proper adjustment, and **WALKS OFF** to the **METALS OUT OF WHICH IT HAD BEEN EVOLVED**, nor pauses in the journey till it reaches home. It will go no further than home, whatever may have happened in its absence to him or his.

In man the needle stands straight up. **IT HAS LOST THE POWER OF ADJUSTING ITSELF.** In consequence he hesitates to send his ten-year-old son away from home; and if himself lose memory, he is lost at a slight remove only, nevertheless he has the strongest local attachments. He gains in other respects. Set down two more propositions.

1st. The moon has great influence upon oceanic water, causing the vast movement of "the tides."

2d. Life's Form is three-fourths water.

One may not dispute either of these propositions if he would have his opinion respected.

Corollary—the water in life's form is oceanic water, and affected in degree with the larger body. It is common belief in rural districts that sleeping with the face exposed under a full moon causes it to be swollen in the morning—dropsical. It is foolish to contend that water in the ocean may be dominated by the moon, but that upon the shore in life's form is not affected. Nor does the matter stop abruptly with the lunar influence, for there are constellations in the heavens holding striking resemblance to forms of animal life and plant life. For a long period of time men have been speaking of the following constellations: Leo, Cancer, Gemini, Taurus, Aries, Pisces, Aquarius, Capricornus, Sagittarius, Scorpio, Libra, Virgo. May it be reasonably doubted that other planetary and stellar influence than the moon is moving the chess represented in particles of matter upon the tables of the earth? Is water only a trifling matter, to be rolled from continent to continent as mere pastime of the moon, or is it quite as respectable as other matter of the earth? If water ebbs and flows in oceanic basins, it ebbs and flows in Life's Form as well, though small it is, escaping notice in consequence. Since water is under influence of the moon, may not similar influence of the stellar constellations arrange matter into shapes similar to their own? Being a less perceptible movement of matter than the vast rolling tides, yet moving nevertheless though all unconsciously to human knowledge. Impossible, say you? I would not use that term so often. It is not more incredible than for two men to hold conversation upon opposite sides of the earth, directing each other what to do for him where he is standing. This is of hourly occurrence through electric currents. Agriculturists have their signs for planting; carpenters for cutting timber they wish to use. I would not laugh at them, since they are dealing with nature, and you with your imagination only. The little stars which constitute Life's Form are beyond reasonable doubt affected by the larger bodies moving near them. Water rolls in huge waves under lunar force. May there not be motion taking place within this motion, and matter arranging itself in form of a crab by potentiality emanating from the stellar constellation of that shape? The temple of life is built with minute stars drawn into place by magnetic force pertaining to the vast stellar circulation. Is it longer matter of won-



der why you gaze so tenderly into the firmament? The earth is the womb—the firmament is the body of your mother.

Life embraces every motion and form of evolution, and since there is archetypal form to the body, there needs to be archetypal form to thought itself. There is such archetypal form to thought furnished in the SUPREME INTELLIGENCE.

There is matter of much import concerning man which we may not pass over in silence without doing violence to our judgment of things. Suppression is not the order of Nature; on the contrary, evolution is the eternal method.

MAN IS A GROWTH. This much may be admitted without harm to anything but tradition. Much of that has already been discarded without hurt.

## TO THEOLOGIANS.

Gentlemen! We have not aught to say against Religion; on the contrary, believe conviction in the existence of a Supreme Intelligence to be the primordial feeling in human life, far exceeding any other in the mind of man. This is not what men struggle against, but with the varied systems of theology which have been evolved at intervals, and are full of error and preposterous assumption—being no less than that they were special communications and personal interviews with the August Power of the Universe.

To probe this matter a little begin at the cardinal point of inspection for the higher races—the Hebrew Bible. Take the slate and write down two propositions, viz;

1st. Man is of God, and made by His own hand.

2d. The Holy Bible is Divine.

Interrogatory: Which of these two editions of the God-Head is the elder? There is only one opinion between us.

Set down two more propositions.

1st. Science says man is three-fourths water and one-fourth made up of Carbon, Nitrogen, Lime, Phosphorus, Iron, Soda, Magnesia, and traces of several other minerals. \*

2d. The Hebrew Bible says man was made of clay and the dust of the earth.

\* O + H included in water

Interrogatory : Which of these two statements is correct ? There is much clay where Moses wandered ; moreover, he had not the remotest idea that man is three-fourths water, else he never would have committed so grave an error in HIS Genesis.

Set down two more propositions.

1st. God made the Heavens and the Earth, and all there is, in six days.

2d. Science says, the testimony in the Geological strata establishes gradual evolution of the earth's surface, occupying millions of years in the labor of construction.

Which of these two statements is true?

There is no occasion to extend the matter. Wrong in the cardinal points, the matter of detail is of secondary importance. Moreover, testimony received from unreliable witness is at election of qualifying circumstances only. Your trouble has ever been from attempt to enforce unqualified belief, and create implicit confidence in the truth of every statement of the Hebrew chronicles, emphasizing every word and letter upon the ever-growing human mind, threatening it with damnation if it showed resistance. Ah ! 'tis a long, sad tale ; pitiful, too pitiful, too horrible, too agonizing, too monstrous to recount upon a summer morning in the sweet sunshine. It was the sad havoc of delusion and monomania, from excessive religious fervor and ignorance. When this was done you had implicit confidence in every statement in that book of chronicles and traditions. You are still convinced it is Divine emanation, and so are we ; but we look at it from different standpoint. We reverse the order of the outlook, regarding it from the antecedent edition ; but you have ever regarded man from the standpoint of the Bible.

Your Bible is archetypal of the God-Head and GROWING FORM of Divinity in Hebrew evolution. Their traditions and chronicles are measure of degree of progression only. The Bible is chronicle of Jewish growth. Its later products are, therefore, always higher than those which preceded them. The truest, best and highest form of the majesty of the universe contained in that wonderful human chrysalis of Divinity is the Great Nazarene. His misfortune was in UNFOLDING THE DIVINE IMAGE more rapidly than the rest of his race, his crucifixion being the price extorted by popular homage to the traditions of Moses. HE HAD OUTGROWN MOSES AND THE PROPHETS. Jesus Christ is by far the loftiest character in the Bible. He was not pure Jew, however, but

had FOREIGN BLOOD in his veins, developing more rapidly in consequence. Nor his hair, nor his blue eyes, nor his face is Jewish, but rather North German. The doctrines which he taught are charming, are sweet indeed, and will live forever; for what is true is imperishable. His poverty, early education, and kind disposition, made him unusually patient and forbearing, whilst his wandering and romantic life, with its periods of abstraction, contributed in large degree to hasten cerebral evolution. He mapped out the line of progression the intellect must take to see Divinity from human standpoint. Being true growth, he will be always luminous figure-head in past time, worthy to be beloved. The misfortune is his followers worshipped him, and in their credulity and ignorance made him one of the God-Head. And in order to carry conviction in that age of superstition made him do incredible things. He was an enthusiast contributing somewhat to the result.

It is irrational in you to be forever relegating all virtue to Revelations. Your Revelations pale in presence of the pronounced character and lofty virtue of Christ. Those Jew evolutions of internal consciousness were far transcended by the Nazarene. His admixture of foreign blood made him much greater than a Jew. A pure Jew is a Mosaic worshipper to-day, and will ever be so long as he remains a Jew. Large numbers of the human race have outgrown that species of men and their silly legends, passing them in the race of evolution, their bigotry and exclusiveness having been their ruin. They attempted a nobility upon a false basis, sticking to a form of religious evolution, saying they were "God's chosen people." It is not strange such bigots should be left far back in the past with the God they had monopolized, and had met so often in secret rendezvous, to gossip with about fallen man, to carry fresh messages to the wretches who had had such a fall, and had set their hearts against Him. There is no proprietorship of Divinity on part of the human intellect. The animus of offence of the Nazarene was that he preached to the Gentiles, striking a blow at the vital point of their false nobility. Since then the intellect has continued to grow away from the Jew, leaving him farther and farther in the midst of the decayed past. In his heart of heart man feels the Jew to be in his way and hates him. Nature is true to herself. It is the solemn duty of theology to gather what it may find of Divinity and of virtue in that remarkable Jewish book and consign the rest to the Jew. What you take away is not his. The Testa-

ment holds all the virtues of the old Bible without its abominations. There has been tacit performance of this duty, a recognition of the fact that we have outgrown Moses and the Prophets.

Theology has done great harm by unceasing effort to resuscitate and perpetuate upon present time the crudities and stupid sayings of a barbarous age.

The mound it has reared with the bones of those who ever protested against the abnormality, is oppressive sight to look upon even in the setting sun of receding time, under the mellow light of memory and human charity.

Theology will have hard effort to get away and be off to the great future. You could be of incalculable assistance to higher growth of Divinity by promoting thought; but instead of doing this society has to pull you along by main force. You linger about the tomb of Jewish life. You belong to the present, not to the past. The 19th century has left Moses and his savages far to lea-ward upon the ocean of thought.

That bloody ground has been fought over sufficiently often, and that you came up out of that heap of ashes is no reason why you should be forever returning to it and make attempt to burrow into that enormous sarcophagus. You take example of a roaming tribe of savages as proper mentors for the 19th century. You go to the infancy of a race for intelligence. Man has only one childhood, the other is imbecility. It is pitiful to have you ever standing with your face backward drawn by the loadstone of mental inertia to that past. You are forever looking into that gloomy graveyard, trying to decipher the hieroglyphics of deceased species of men to make out which was greatest. Your homage is so deep and your servility so mean that their most suppliant slave could do no more, memorizing every word you may find, and embracing every fossil and piece of rotteness. Onward and upward is the line of life's momentum—not DOWNWARD and BACKWARD. That Golgotha, the Past, you are to stand upon, tracing only the rootlets of your language running into that vast cemetery.

WHO MEMORIZES THE PAST IS LOST TO THE FUTURE. It will crush his intellect. The more he ruminates through that gloomy arena the more he grows like it, in obedience to the law of environment.

What of the rootlets of his language, what of art, what of science he may find let him seize with avidity, and turning



his back upon the accursed spot, his face to the great future, step out bravely in the fulness of intellectual manhood, the glory of emancipation full upon him. If he does not thus he becomes a toadstool, lost to the generations which are to come after him.

The mind of Socrates and Seneca had not origin in Revelations, nor any of the greatness you call Paganism. Calling names does not remove the trouble nor make falsehood true. Your Revelations never produced anything; on the contrary, were evolved out of what had been in existence for vast period of time, to be themselves supplanted by future growth of intellect. There is a book so old compared to which your Revelations are in feeblest infancy. Do you wish to know where the infant had its birth? Be patient. The Hebrew intellect evolved Revelations out of its inner consciousness, reading the passages written on the walls of the temple in which it dwelt. It had partial consciousness of the vast significance of its abiding place, delivering itself accordingly. It was confused articulation of the order of the universe through the momentum of his own organic form, and foreshadowing of the possibilities of cerebral growth and mental motion. But it was not near so great as was performed by Jesus of Nazareth, though the Evangelist had fine mental power exceeding any other of his species who came after him, till the men of the 15th century came upon the stage, since which time religious momentum has been an ever increasing one, growing more and more conservative and more in harmony with universal order and constitution of the visible universe. Intellectual liberty has accomplished much for religious sentiment, taming its natural ferocity and impatience, making it lovable. But Theology has work to do before adjustment will be complete. It has strongest reasons to justify its constitution of the God-Head, but its duties only begin here. Your high vocation is to aid mankind—living men. You are living in present time; tell us what you know of it. I would not stand there any longer ringing up the past, gesticulating with some violence, talking a great deal, and at times shrieking about this past. What men wish to know more of is present time, and less of the past than it has heretofore been crammed and stuffed with, till they cannot endure it any longer and leave you in disgust. Do all the good you can in God's name; it is your high privilege and bounden duty; but do you not see what is taking place all around you? You term it growing cold in the cause—a fall-

ing away from grace. God help you out of your infatuation. The truth is men are tired of this ever ranting of the past. Mark you, if you continue it longer your pews will contain only women and children, half-grown men and half-grown women. You will have gotten rid of men. Study the matter a little more attentively and notice whose church is fullest, and where intellect pays profound attention. The revelations men will listen to must be of present time, and what you are doing to help men out of the Slough of Despond. Talk less of the past and make report of all the earth that you may hear from, what men are doing for themselves, and how you are assisting them. All men are your brothers, and some are in want of everything but life—they are tired of living. This is horrible in the extreme. May you not do more by living in present time and aiding these men a little by intelligent instruction how to go to work upon their environment to improve matters. Your catechisms do not teach them; on the contrary, they make attempt to rattle up the past. Never was child so tired of catechism as are grown men of this unceasing ding-dongding about those Jews of yours. Their NOMADIC descendants are indifferent; they never stop to listen to you. Mayhap they have bad judgment.

Pardon us, but we had fancied your vocation had reference to living men and not to dead ones. Teach men how to live, that when dying blessing you you shall be blest. Say you it is irreligious? Irreligious! that is word of yours, coined in the mint of your imagination. Know you who man is? Read from a volume, containing text so old compared to which, in point of time, your Jewish chronicles are but moments to countless centuries. Open the Book of Nature to find out the meaning of things and how your text came to be written at all. Learn how man articulated thought which is imperishable, beginning to do so in remote time and gaining in intensity as he journeyed on till the present time, thought being an ever-growing quantity. Years and years ago he had attained a point of evolution when inner consciousness could make out the footprints of a Divinity within him. He said startling things to his auditory after these communings. All systems of theology have had such origin, ever becoming more and more distinct in utterance, till at last in those Jewish chronicles there is evolution of a Trinity in the God-Head. And religious conviction of the existence of a Great Book in which all things are written is also true. There is such book—it is the human body.

It is susceptible of demonstration upon an anatomical basis and physiological performance that there are three dominant forces in the universe.

We live in a tripartite government who operate the heliocentric system through inflexible law by assistance of five executive officers or members of the cabinet. There is difference in degree of power in the God-Head, as also in the cabinet, since there is a central figure in the former and a central figure in the cabinet.

How may one form such opinion? And where is evidence to support such statement that may undergo intelligent inspection? Proceed in the order of nature and follow patiently the steps of the journey to the highest point of observation, beginning with the first letters of life's alphabet in the Geological strata, and proceed to acquire knowledge until you come to the HUMAN BODY, when you will be qualified to translate it. ANATOMY IS A LANGUAGE. The three great ponderables—earth, air and water—constitute THE TYPE. The three imponderables—light, heat and electricity—the forces which are used to set up this type for publication of the universe. The leaflets are in the flora and the fauna, the compilation of it all being in that latest edition, the Human Body. A last edition should embrace the virtues of all preceding ones; this greatest of books is no exception to that law. Man contains everything. His Head is impersonation of governing majesty; his Body a miniature of the heliocentric system and book of chronicles. Regard it as complete in itself, the members being attached to it for its support and direction, whilst the head, the great seat of power, is far above it. That little heliocentric system has support on two great props or crura, which terminate in two pedestals. These pedestals have five terminal digits each, with a great inner one on either foot, called the great toe. Set down these factors to themselves and proceed up either column in search of higher expression of these factors. Evolution has a scale of ascent.

There are five Lumbar Vertebrae, through whose articular facets the whole trunk is rendered flexible.

Regard the upper extremities. There are five terminal digits to each of these, with the strong inner one in the thumb. Here is higher elaboration and more marked individuality in the several members. Persevere in the ascent; the head is reached. Look at that remarkable semi-circle of the five senses, with the strong, well-marked inner one giving charac-

ter to the whole face—the nose. These factors are all around your universe. Moreover, they guide, feed and sustain the body. These are representation of the five great cabinet officers, the presiding one in the middle.

Where is solution of the Trinity? Is not all that great reach of brain substance over and above the semi-circle of the five senses? Does not the intellect reside here as autocrat of all below? Do not the limbs obey it and the senses heed its bidding? They may all fail, yet if the intellect survive to ask for food and raiment life continues in the body, as in the paralytic. Look at its place of residence; there are two great brain masses—the right and left hemispheres. Is this all? Do they not generate electric fluid, which reaches with lightning speed throughout the entire body, commanding it to perform? What power would the brain exert over the body in the absence of this pervading spirit? Religious sentiment has evolved a Trinity, one of them the Holy Spirit. The relation of the other two, as being father and son, may not be shown to exist; nevertheless, one is much greater than the other. In this inspection follow Nature closely, beginning as before at the ground. There are three bones to the leg, the tibia and fibula below, the femur, or thigh bone above. The latter is the equal of the other two in strength and weight; moreover, is above them. Ascend higher. There are three great pelvic bones, the os sacrum, higher than the others and base of support to the body, regulating the two side bones and capacity of the pelvic basin. Look at those two side bones the ossa innominata. They are resolvable into three bones each, a great broad portion above (os ilium,) equal to the os ischium and os pubis, forming the lower two portions. Ascend to the upper extremities. There are three bones to the arm, the upper one in the os humerus, the equal of the two bones below, radius and ulna, forming the skeleton of the fore-arm. The two great crura, with assistance of all-pervading nerve fluid, support the body in erect position and determine which direction it shall move. The two upper extremities that feed it would be impotent in the absence of the all pervading nerve power. Three then is the dominant factor to animal organisms, and number of the potentialities which rule its behavior, there being difference of virtue in them. This great power sits above the solar system, the seven cervical vertebræ representing the seven cortical layers. The number of bones, two hundred and forty, have representation in planetary space. The twelve ribs around the heart, and



twelve dorsal vertebræ, are its Zodiac, holding all this system together, whilst the great central organ of the heart sends out the life-giving fluid that builds up everything.

So much for the constitution and relations of the august potentialities of the vast autonomy of the universe, written in anatomical symbols through Life's Form. Let us see further into this wonderful book to make out how much the Trinity is spoken of. There are three great factors to the circulation of the juices, viz: Atmospheric pressure, muscular substance, and nerve force. There are three great vessels in close association in the umbilical cord which constructs life's form. There are three comprehensive systems of vessels composing the vascular apparatus, viz: Arteries, veins, and lymphatic vessels. There are three great openings through the diaphragm for transit—the three large conduits, the œsophagus, aorta and vena cava trunk. The venous tube of intestines has three great anatomical sections, viz; 1st part from mouth to pyloric end of stomach; 2d, from stomach to colon; 3d portion includes colon, cæcum and rectum. Either of these portions is resolvable into three subdivisions, which are again resolvable into a like number of lesser divisions. The buccal or mouth cavity, the pharynx, and stomach are in the first portion; the duodenum, jejunum, and ilium in the second portion; the ascending, transverse, and descending colon form the terminal portion of the tube, etc., etc.

The renal territory has extension of the law. The kidney has its cortex, its medullary substance and pelvis; the latter has its three infundibula. The bladder has its three tubes, two receiving and a discharging one; so has the womb. These ovoidal bodies have each three grand compartments or regions.

There are three great divisions of the nervous system—the brain, spinal cord and sympathetic nerve. Nerves have three fundamental elements—neurilemma, axis cylinder, and the white substance of Schwann. The body is divided into three great divisions—head, trunk and extremities. Its envelope, the skin organ has three divisions—epidermis, rete mucosum, and cutis vera. The trunk contains three great cavities—the cranial, the chest, and abdominal. Either of which is resolvable into three lesser ones, as in the cranium there is the right and left hemispheres and cerebellum, the entire brain substance resting within the three great fossæ at the base of the skull itself. The chest has its two pleuræ and pericardial cavities. The abdomen has its compartments in the hypochondriac re-



gions, the soft abdominal regions and the pelvic excavation, containing organs with a fundus, a body, and a neck. The extremities have three great natural divisions, viz:—the arm, fore-arm and hand; the thigh, leg and foot. The hand is resolvable into the same number of divisions, viz:—carpus, metacarpus and phalanges. There is a shoulder, an elbow, and wrist joint; a hip, knee and ankle joint. The law has extension to the bones themselves. There are long, flat, and irregular bones. Bones have an external, an internal table, and an intervening diploe. There is a shaft or diaphesis and two extremities. There are three inlets into the body for the transportation of the solids and fluids for the support and construction of life's form, viz:—the mouth and two nares. The nose has its two alæ and septum, and its bony skeleton has three pieces, two ossa nasi and vomer. There are three turbinated bones. The eye has three great divisions, viz: the aqueous, the crystalline, and the vitreous humor.

Making one more reference, we will refrain from further reading at present, since the matter has extension into the minutia of construction, running through the fauna and the flora.

Sound is transmitted over a mechanical contrivance eloquent with the Divine autonomy. The auditory apparatus is divided into three great divisions, resolvable into an equal number of subdivisions of generic factors, viz: the external (auricula) including the external canal to the membrana tympani; 2, the middle chamber (the tympanum,) lastly, the labyrinth or internal ear. The first resolvable into the helix, the lobulus and the concha, with subdivisions into the tragus, the anti-tragus and anti-helix. Sound is conducted through the middle chamber over a chain of three bones (the malleus, incus and stapes,) and delivered into the internal ear or labyrinth. This is the most complicated portion of the mechanism, marking progressive increase of complexity. The labyrinth is divided into three portions, viz: the vestibule, semi-circular canals and cochlea. These divisions are again resolvable into an equal number of subdivisions. There are three semi-circular canals, enclosing an equal number of divisions of the auditory nerve.

When the intellect rises up from the contemplation of this wonderful mechanism it must believe in a Divine intelligence, and have impression that the vast autonomy of the universe is a tripartite government, publishing the God-Head in the book of life—the HUMAN FORM. Out of the inner consciousness three grand words have audible articulation from that

great æolian harp, the human brain. Thou, God Divine—Omnipotent, Omniscient and Omnipresent ! Is it longer matter of wonder, thou Man of Nazareth, thou didst deliver immortal utterances? As long as the human race continues thy memory will evoke unspeakable love.

We have seen that three is dominant factor in animal mechanisms, the foundation of anatomical construction, and that the factor five is administrative only, never suffering displacement from this relation ; and the influential position they hold outside the organism has continuation to the internal territory, as is well exemplified in the hepatic organ. The liver superintends and watches over hæmatosis. All the blood gathered by the radicals of the portal vein is passed through that wonderful mechanism for filtration and higher elaboration. It has five as its ruling factor. There are five ligaments, five lobes, five vessels and five fissures.

It holds pre-eminent position in the abdominal cavity, both in relation to function and height of elevation over the other viscera.

The cabinet has representation in the blood organs, a continuation of the external relation supervising the manufacture of blood, as they had directed the body for securing the rough material for its elaboration.

A rising scale of consciousness is measure of the tone of vibration of the cords of life's great harp, whilst History is chronicle of the journey. The religious revolution of the 16th century is measure of intellectual momentum, extending itself over the cerebral cortex of large numbers of the highest types of the human species, testifying to the truth of the immortal utterances of Christ with reference to the God-Head bodily, the God-Head spiritually, and true relation of man to man. The key-note sounded by Sir Isaac Newton and M. Harvey is further evidence of intellectual momentum and diffusion of the wave over the entire solar mechanism, with invasion of life's form, the product of stellar motion, the mighty artist sitting above originating that vast mechanism and sustaining it. Matter is visible evidence of imperishable law, hence as eternal as the law itself. Unnatural event is spoken of in Hebrew Chronicles quite often, but with steady diminution in frequency with the increase of intellectual evolution. Unnatural event there never was in the earth, nor may it be shown to be in keeping with the harmony of all-pervading law. Imperishable testimony engraven with fossil flora and fauna declares in lan-

guage not to be mistaken, that progression has been steady and uninterrupted. It is foolishness to say otherwise, and bad judgment to attempt to invert the order of events in the earth. The observant Israelite saw the evidences of a flood all around him ; the rest he evolved out of his imagination. The intellect of to-day knows a little more of the history of the flood, and of the composition of man's body, than that remarkable waif of the bulrushes adopted by Pharaoh's daughter, and only freedman in Egypt. Such knowledge was not to be had in Egypt among slave-owners, let alone ignorant slaves. By reason of his superior education he had no difficulty in performing a great role in the face of this simple race, and to impose upon them to any extent. Having run away with him from their Egyptian owners, there was nothing for them but what these nomads could take by violence and brigandage from unresisting nations on their line of march. The nomadic existence which the freed slaves led for so long a time is a peculiarity of the race. Moses had his hands full ; no one knows how much trouble he had with the savages, but may form some idea of it from the number of extraordinary appeals he made to their superstitious fears, keeping them in the traces of mental discipline and restraint by terrible denunciations, and not unfrequently necessitated to make fierce example of the more rebellious. He ruled his Hebrew ruffians through terrorism, not stopping at anything, making frequent use of their faith in the supernatural to accomplish his end. It was a thankless service. He finally disappeared in a mysterious manner. His pupil and successor, Joshua, was like him in many respects, for it was he "who stopped the sun" in order to prolong a bloody massacre in the mountains of Palestine, which he and his brigands were wrenching from the rightful owners. After having been despoiled of the arable lands of Palestine the forlorn natives rallied in the mountain passes, fighting the best they could in defense of their little homes and firesides. But this horde of nomads had to be kept employed to prevent mutiny over the spoils they had taken. They did not actually want the soil, for that race never sow and reap as other races. The Books of Moses is wretched tale of murder, rapine, spoliation, crime, and heinous immorality. One thing we may rest assured of, they never told the half of their infernal deeds, being their own historian. If such be virtue to be lauded in this hour, God save the name.

One of the most astounding circumstances of this age of civ-

ilization and recognition of human rights (the right of property being held sacred,) is that pulpit orators should elect this savagery and diabolical performance as exemplars of God and religion. It is amazing. If it be attempt to inhibit inquiry and investigation it is a great mistake. Mankind will sit in judgment upon those deeds despite the protests of theology. The love of truth for its own sake is growing quantity in the human intellect, **THE MEASURE OF INCREASING VIRTUE** and of mental evolution. It is organized crime on the part of theology to make attempt **TO SUPPRESS INQUIRY. TRUTH DEMANDS INVESTIGATION**, and Moses will have enough of it. Religion is child of truth; superstition is other name for ignorance—it is the night of intellect.

The stakes have been much advanced of late into the stygian darkness through the courage and industry of scientific engineers, and proclamation of this sort is made all along the black border. **EVERYTHING MUST BE SUBMITTED TO INSPECTION OF THE SENSES.** Education of the senses is the true mode of informing the intellect. To **OBSERVE** first, to **THINK** afterward is rapid care for dreaming dreams and evolving hallucinations.

Man now knows he advances **ONLY BY HIS OWN INDUSTRY**, and performs **HIGH** or **LOW LABOR** according to his knowledge and opportunity of being taught, never having received the slightest assistance along the entire journey from any Revelation, good, bad or indifferent; on the contrary, has cause to remember them with unspeakable sorrow.

He is aware of the advantage of **A GOOD ENVIRONMENT**, seeking how to improve upon it for more rapid consummation of what he wants in animal life and plant forms. And he will do better yet than ever before when he submits himself to the law of hybridization more completely than he has yet done, preferring to add up the potentialities in the mind, stored in cerebral convolutions, rather than promote the aggregation of personal property and landed estate. **THERE IS ONE TRUE AND IMPERISHABLE NOBILITY**—that of intellect. Nature is true to herself. The **WORLD IS DOMINATED**, and will ever be, by **HYBRIDS OF THE HIGHEST TYPE**. The English are highest order of hybrids (there is difference in them) **MEN MUST HAVE ADDITION** as well as horses and roses, beginning with the best type of the highest species. Republics do so well by reason of less



resistance to this scheme of human culture. They need to understand it better than they do. The eternal order of nature is to look upward through the affections, to climb higher and higher, ever climbing. To step down is a violation of the first law of nature. Onward and upward in unceasing struggle for better growth and higher elaboration is the all-pervading and dominant law of evolution.

Thought is evolved OUT OF LIFE'S FORM, being highest product of it, hence THE TESTIMONY GIVEN ALL ALONG THE JOURNEY OF MENTAL GROWTH IN CHRONICLES kept by different species of men, differing in quality according to degree of evolution, constituting the letter of their religious faith which they cherish and preserve. Every species of men who have advanced to sufficient evolution to keep a chronicle of events have religious sentiment the most conspicuous, with great leading characters as figure-heads, occurring at long intervals of time, so slow is mental evolution. The species of men dwelling in Palestine kept good chronicles and preserved them well. Being a high race they evolved much of the archetypal form of the God-Head, which has such faithful correspondence to that evolved by the inner consciousness of the 19th century. Being archetypal it is imperishable. The duty remains for the higher intellect of this age to eliminate it from the vulgar vesture of Jewish habits in which the priceless gem is embedded. Amid the rubbish there are many beautiful pearls.

What matter is it, so far as truth be spoken, which distinct species, OR INDIVIDUAL OF THE SAME, first elaborated life's highest archetypal form, in religious evolution, and gave articulation to imperishable human thought, and a voice to silent language in the mind of his fellow-men, who by reason of this fact crowned him a hero and a God? What the intellect needs is exact information of what it is, and how it exists in this terrestrial environment, holding on to true information and rejecting mythology. Superstition is suffering much retrenchment, growing less and less in power to do harm.

We live in the midst and are evolved out of imperishable affections. It is mark of childishness and savage credulity to repeat old legends making man a stake in a game of chance, the cultivated and informed falling to the devil.

It seems incredible at this day how the human intellect could entertain it. One, however, should remember there was such time when it knew how to satisfy only immediate wants of the



simplest kind. It has grown much since then. The bonds of mental slavery are cracking with fresh fissures, everywhere falling off numbers of men.

The hardest work man has to do is the cultivation of his reasoning faculties. Environed in a thick fog of superstition, the way has been most difficult and progress very slow; yet some advance is being made all the time. The world is better than it was even a century ago. Who says differently speaks without law and against overwhelming evidence. He speaks of his sensations only, not of human growth. However slow it be, ultimately the true remains to tower above the false. At last the intellect has reached a point of elevation where it may no longer suffer intrusion from devil or triar. They perish in the attempt to reach that ascent.

Since the law of evolution is made out, a rule of general application is of ready formulation, viz; the amount and degree of unreasoning faith (superstition) is measure of defective cerebral development. There may be degree of intellect with large amount of special knowledge, yet the individual fall below the highest cortical expansion ~~improportioned~~ as he sinks in credulity and faith in the marvelous. The reasoning faculties are in abeyance, whilst memory is enormous. The individual PERFORMS ACCORDINGLY. The female sex, as a class, have six to eight ounces less brain substance than males. They are very superstitious and fanatical. That sweet frailty fancies itself to have one rib more than man, thinking of Genesis. Her flexible nature takes its shape from the mould of that rugged Hebrew mythology.

One may not run away from his own organization. He is inside of HIS FORM and must stay there, working away with all his might upon his brain substance. How to grow mentally is the problem of problems. To change one's height or his sex is an impossible performance; he is walled up in an unyielding casemate.

Man has voluntary power to effect LIMITED alteration upon the environment for promotion of growth to higher cerebral elaboration, which he accomplishes by patient inspection of visible properties of matter and knowledge of physical law. He desires to do well—is doing better than he did. He makes attempt to follow example of Deity in constructing wonderful mechanisms. Steam machinery is not feeble imitation of animal mechanism. If man could find what he is seeking for so earnestly—PERPETUAL MOTION, the thing would be done.

At present the terms upon the slate read: the highest animal mechanism may evolve and elaborate other lower forms of mechanism, a motion within a motion, having gradation. There is persistence of the law—**THE CREATOR IS GREATER THAN THE CREATED.**

To conclude:—in the illimitable expanse, as far as mental motion may propel its wave till it exceed the solar ellipses and break upon the God-Head, there is continuation and persistence of law. Everything is conserved in imperishable law, and **IT IS NOT POSSIBLE FOR ANYTHING TO BE LOST.** There are no fragments falling into hell. Nothing may escape from the embrace of the solar mechanism but **THOUGHT**, which is potentiality of the God-Head Itself. All is well.

Gentlemen, you should travel more. Those of you who are able to do so commit a grave error by neglecting it. Instead of marrying so soon, your first savings should go in this direction. Place yourself upon a steam carriage which intellect carves out of the children of the forest, and sends rushing over the great magnet of the earth by aid of solar heat turned loose upon iron cylinders, (having laid dormant in coal for thousands of centuries,) and look you out of the window to the right and to the left upon everything, as if with intent to purchase. Go down to innermost depths through hidden stairways dug in the earth's side by the children of men, intellect leading the way, and examine the leaflets carefully as you descend. Visit subterranean passages carved by hidden streams with blind fish in them. The sculpturing in mammoth cave, of vast halls chiseled out of solid rock, with bottomless pits leading down into infernal blackness, with jaws standing ajar for him who stumbles, will give impetus to thought and grandeur to present time. From high plateaus on the Rocky Mountains cast your eye down declivities more than 5,000 feet deep, (some of them half a mile in width,) dug out of solid limestone by etchings of water which falls only from the dew of heaven. The ocean is mother of all that marble which she is transporting back to her own bosom again after such long absence. Thousands of centuries ago her myriads of swarms of coral insects did the labor of constructing it, when a vast subterranean force suddenly elevated the sea bottom, and you are regarding what has happened since. How many drops of dew did it take to do all that carving? Are you disposed to enter into the calculation? It is madness; however, if you are bent upon the in-

quiry, set down as first term of the proposition the number of grains of sand on the Pacific coast, and multiply them by sufficient drops of water to chisel out the flinty crystals from the elevated plateau and transport them to the ocean side. The sum will be an unspeakable number of years. You must not stop at this. Place yourself upon a steam mechanism which wades out boldly over the powerful magnet of the ocean, drawn by solar force under guidance of intellect, and when the steam-boat rides you as a feather upon all that motion, and you look from sky to sea, and from the ocean to the firmament, where motion is yet more vast in the wake of rolling planets, and your inner consciousness is awake at last to the momentum of the universe, think of the despised Copernicus—of Giordano Bruno, of Galileo. The Teutonic Pole was out of your reach in the midst of the brave Germans, but what of the two latter? On February 17, in the year 1600, a most brutal public murder, a most savage and inhuman one, was committed in an open square near the Vatican. Giordano Bruno was burned alive. The Nazarene perished by crucifixion for unfolding the Trinity. and the divine rights of man. The Italian was incinerated for unfolding the universe, and the heroic virtue displayed in the midst of the burning fagots is the peer of anything in history. The Religious Revolution of the 16th century had its army of martyrs drafted from the noble and heroic of the earth; but the 17th century led off in the struggle for intellectual liberty with as noble a victim as Theology had ever burned at the stake or tore into ugly ribbons with the teeth of the inquisition. **BIGOTRY IS A BLOODHOUND**; when fully aroused it is a monster. The time it takes to cool its blood is mournful in the extreme. That poor old man, Galileo, in his 70th year, to save his life was necessitated to kneel upon this tragic ground thirty-three years subsequent to this event, and made to recant the Copernican theory and to promise he would never more teach that the earth revolves and the sun is stationary. To make the abjuration more impressive, and if possible more binding, they caused him to spread both hands out over the Hebrew chronicles and dressed his noble person **IN SACKCLOTH**. Notwithstanding they condemned him to imprisonment at the inquisition during pleasure; finally he got free of a living death upon his taking a vow worded by them, declaring his detestation of the proscribed opinions, with a promise to recite once a week for three years (as long as they thought he could live,) the seven penitential psalms. But

they set a watch upon him, and when that immortal philosopher and mathematician was cold in death, refused his bones a resting place. Say you 'twas the work of zealous Catholics? But for the revelations of science you would do the same to-day. You are all alike in essence. You grow restive, intolerant—**FRENZIED UNDER SCRUTINY**. You of all men living are bent upon having your own way, cost what it will. **YOU** are helping God Almighty, whilst **THOSE OPPOSED TO YOUR NOTIONS** are enlisted in the army of the devil. The Calvinists hated Science and Philosophy. But the 19th century is what it is because of the labors of those matchless twins. They have rent into fragments that horrible and monstrous theological web, with its infundibulum resting upon Rome, the nidus of its **TARANTULA**, where human flies administered to it. For centuries nearly all of Europe, boots and spurs, was in this web.

Superstition also has its cortical layers, where fossil pterodactyls and monstrous megatheria may be found. In the 19th century smaller and more agile forms have taken their place. To keep up a show of life in Hebrew chronicles a new art has introduction into human experience called Allegory. So that when some long-established opinion, moss-grown and hoary from Mosaic time, is forced to yield to inevitable logic, you slip in quickly by dextrous movement a flaming placard with only two words written upon it—"an allegory," and place it over the ruined text, every word and letter of which you had previously insisted was true and unchangeable. You are aware this invention is designed to conceal a new rent in the sides of the Ark of the Covenant. **THESE UNHEALED FISSURES** are now grown very numerous, and presently the whole truth will be out, when all will be but Allegory and BIOGRAPHY.

Ah, gentlemen, it is common circumstance with you to do this thing, but is it honest? Is it just to intellect? Is it **ALL THE RETURN** you propose to make for its vast labors, its prodigious sacrifices, and last, though not least, for unspeakable sufferings endured at your hands? Remember the law:—he who asks for justice shall do justice.

One dense shadow after another is dissipated by the white light students place underneath its black drapery; and one falsehood after another is nailed to the counter with unyielding rivets wrought by science out of the furnace of truth. Hark you! for you are to undergo investigation also; there are

men coming who will sit in judgment; and what is noble and true in your utterances will live to posterity, but what is false and hurtful will perish utterly. Adieu!



## CHAPTER III.

### THE TERMS OF INDEPENDENT ANIMAL EXISTENCE.

#### THE PLACENTA.

The question of FERTILIZATION throughout the fauna and the flora is a settled one, and for the purposes of this paper there is no occasion for a recapitulation of the pains-taking labors of indefatigable students of nature, in observations of the nutritive changes which subsequently take place in the fertilized ovum in the march of elaboration. It is sufficient to know that whilst lower forms precede the higher ones, the latter must contain ALL THE ESSENTIAL FACTORS of the former, receiving yet clearer definition and more emphatic enunciation; hence, whatever function is present in the placental organ must not only have continuance in the new organism it is constructing, but receive additional enlargement and more distinct provision. Not one factor may be ignored. This circumstance being irrevocably fixed by Nature, it is in order to set down an interrogatory upon the slate, viz: What kind of work does the placenta perform in foetal elaboration? Whatever this is must be added to the new organism, since Nature does not abolish principles; on the contrary, she has an ascending scale of elaboration of mechanical contrivances for their accommodation and perpetuation, ever promoting the best arrangement.

It follows that whatever principle is operative in the placental mechanism during the intra-uterine environment, to have perpetuation in extra uterine existence must have incorporation with the new organism which is being constructed. There is no such thing as abolition of principle, but displacement of a lower contrivance by the substitution of a higher one, is the eternal method. Nature cannot change the vital scheme at birth; she simply enlarges the individual mechanisms, adjusting them for the rude experiences to which they would have exposure, at the same time to enable them to perform a greater amount of labor than the primitive organs. Therefore, to

find the essential factors of independent animal existence, the initial point of inquiry will be inspection of the contents of the womb (taking example of the higher animal species) before expulsion, making note of the essential factors, a prime question being, what is the placenta?

There are two great factors in placental functions, viz: 1st, It manufactures its own blood, using the venous juice of the mother for the purpose. 2d. It has the cardiac power to dismiss this blood out of its cavities into the systemic circulation of the animal mechanism which it is building, else the work of construction would not go on. It must be apparent to brief reflection only, that separate and independent existence would be impossible without previous absorption of these two great factors resident in the primitive placenta. To proceed to the minutia of detail. Placental mechanisms manufacture blood by importations of nutritive material from outside, extracted out of the mother's blood. To accomplish this there is arrangement of innumerable little organs (placental villi,) which extend into tortuous venous canals containing the elements needed in foetal elaboration. No blood of the mother circulates in the foetus; on the contrary, it is but the juice out of which the villi make appropriation of what is needed for the special labor in hand. Hence it is essential that the new organism should have such power of manufacturing blood after it will have been cut off from the placental function; otherwise it would perish speedily. We have already had occasion to advert to the great analogue of placental villi and the tortuous venous canals in which they feed, as having appropriate representation in the intestinal tubing, and vast numbers of villi feeding in its white juice.

In respect to the second factor, or the cardiac force, to ship the blood placental mechanisms manufacture into the systemic current of the foetus, such function must be conceded as a foregone conclusion, since however abundant or however perfect blood elaboration may have been within the placenta, if it lack the power to get rid of it, it would go for nothing, since nothing would be accomplished upon the foetus. But it does have such power, for the placental souffle and the heart of the infant are overheard through the maternal structures, each at its own special labors.

There are two hearts performing work upon the foetal organism—one for the manufacture and importation of blood into its systemic circulation, and one for its distribution to the nutritive processes, both performing work at the same time.

Hence it follows, the new organism must also have full representation of this most important and essential factor, to take its place after amputation of the primitive placenta in two hundred and eighty days. Up to this period that organ had subserved three important functions, viz: 1st, the manufacture of blood; 2d, the oxygenation of blood; 3d, the cardiac force to dismiss it into the body of the fetal organism. These factors are unalterable and eternal; they remain ever the same and must ever continue so. The problem is simple enough in formulation. The primitive placental mechanism answers the vital necessities of a twelve-pound child; but what is placental compensation to fill out the requirements of a three-hundred-pound man? Where are placental mechanisms located in the human body, taking example of the highest type of animal life?

I have made discovery that Nature adds both factors together, combining them into one, by making an enormous cardiac organ—the heart of the independent animal—and suspends the mechanisms for the manufacture of blood by means of reduplications of its endo-cardial lining, after the manner of the forming of the valves in the little primitive organ, and known by the anatomical names of peritoneal and pleural ligaments, whilst it delivers the blood so manufactured from substances called food, into the systemic circulation by its own cardiac power through a special umbilical vein (the Vena Porta.) The pulsations in the placental souffle have large analogue in respiratory movement, which are the pulsations of the great heart of Independent Animal Life. This heart contracts upon blood contained in a system of flexible tubing instead of upon naked blood as in the prototype

In the rudimental organ the villi of the chorion in due time become the villi of the placenta, and projecting into venous canals make appropriation of needed nutrient constituents, which, after passing through the placental mechanisms, is delivered into the radicals of the umbilical vein. The homologue of this is seen in the transfer of the products of the intestinal villi to the radicals of the portal vein, the new umbilical vein of the independent animal, under safe protection against external violence. And the cardiac power resident in the placenta, represented by its muscular substance, has its great analogue in the muscular substance of the abdominal walls, including the diaphragm. When it contracts the blood contained in the portal vein is driven over the old road-beds through the liver that blood of the primitive umbilical vein had previously

traveled, making use of every canal and passage-way in this comprehensive system of tubing, (for it is all umbilical,) with final escape into the ascending vena cava trunk by the common channels of exit the of hepatic veins. The placental analogue is not yet complete, for perfect blood needs to be oxygenated, which is accomplished through the mechanism of the pulmonary apparatus, where exposure of its carbonized iron takes place on a larger scale than in the intra-uterine environment. The oxygen of atmospheric air and the oxygen of the maternal blood is the same, whilst the magnetic force which deoxydized iron in the red corpuscles exerts on oxygen has universal application. Oxygen will make its way through diaphanous membranes anywhere to satisfy its powerful affinity for unoxysized iron. Placental mechanisms provide for this law, the pulmonary organs being a still larger provision.

Does the statement meet with objection—that the placenta has cardiac power to empty its hæmic reservoirs into the umbilical tubing?

It will be in order for him who utters this protest to show how Nature does this work; since foetal construction waits on the supplies, growing in a ratio with the amount received, else perishing utterly from its suspension.

Let the circumstance be borne in mind also, that no general force can be made effective upon placental blood; a local one must be shown to exist. Atmospheric pressure must have exclusion, since, acting through the maternal walls, it presses uniformly upon the liquor amnii and all the foetal structures. And if extent of regional surface have influence, the body of the foetus is under greater pressure than the placenta, and the hæmic current would have reversal, going towards the placenta from the body by reason of this fact,

The same principle would necessarily exclude maternal aid, through uterine contraction; it would be felt upon everything. What is essential to the performance of this function, therefore, is a local force, sufficient for the purpose of constringing the walls of the placental reservoirs, and driving out their contents into the vein, as the ventricle does into the aorta trunk. Less than this would not be effective. It is also in order, to explain what other purpose the muscular substance of the placenta subserves, than the one assigned. It is expression of power. Muscular substance always is representation of force, (to be energized on special occasion.) If it should condense itself in this instance under a ganglionic system of nerves, as obtains in the

heart, would it not have the effect to approximate the walls of its cavities containing blood, as the muscular substance of the ventricle approximates its walls under influence of its special ganglia? What good comes of human protest if it opposes physical law? and why make captious objection? Muscular substance shortens when it contracts, is a physical law. If muscular substance over the placental cortex should condense itself, would there not be corresponding diminution of placental area?

Physical law is not pent up in a corner of the body; on the contrary, has universal application. In this instance muscular substance is not in the central organ constringing the blood and ejecting it out of the ventricle into the lumen of the aorta; but it is in the placenta, expressing blood into the umbilical vein.

Thus Life's scheme is rendered perfect in placental elaboration, and the terms of independent animal existence have formal statement.

The placenta is not abolished at birth, but has perpetuation with elevation in the scale of vital elaboration. The several great principles represented in its anatomical construction do not suffer disruption from the vital scheme with ligation of the umbilical cord.

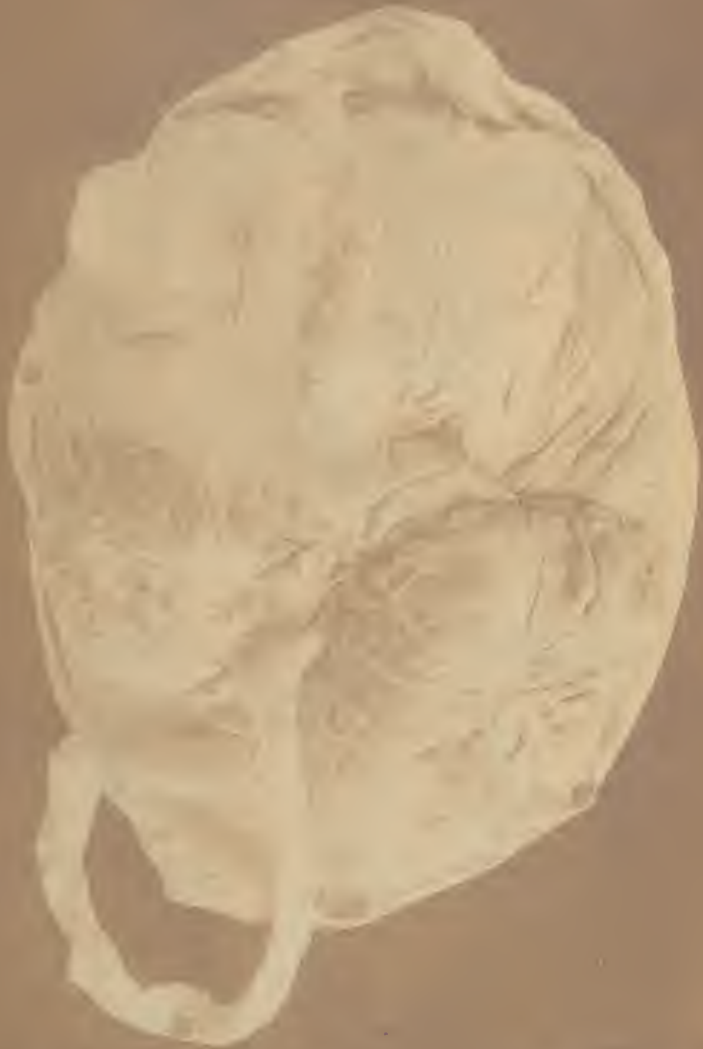
The circumstance is self-evident—the science of Life must stop abruptly and remain stationary till full and complete answer be given of these fundamental constituents.

The crude result of the alterations is to bring placental mechanisms in close and immediate relation with the central cardiac organ or hæmic reservoir, with such modifications in the apparatus for making blood from more crude material than that furnished to the primitive organ.

The accompanying photograph, Fig. 1, is a primitive placenta taken immediately after delivery. It has ovoidal configuration. It does important work in constructing the great substitute which is to finally displace it. The higher growth is evolved out of the lower in keeping with the eternal order of progressive evolution. No conflict anywhere; the matter being one of co-operation in vital mechanisms over a definite roadway, in one harmonious and continuous line of march, from the simplest to the highest of life's forms. Does any one object? What matter is it? no notice is taken of his protest, nature moving on as if it had never been uttered. Is he worse off than before he had such information? verily not; for can



8



Great Hermit



Fig 2

Anterior view



Posterior view

Anterior view



he not buy food and raiment all the same? One thing, however, follows him: he must subsist. How to do this is a problem hung up over his cradle to be taken down only in his coffin.

The accompanying photograph, Fig. 2, from a drawing of placental mechanisms (taken in situ) of the independent animal, is given, predicated upon the logic of vital evolution. The various systems of anatomy separate these organs, dissociating them and destroying that entity and comprehensive unity which is their peculiar and greatest virtue. It is needless to add that the casing in which it is lodged is not only essential to its preservation, but contributes most important aid in the labor of the blood circulation. The whole trunk is a placenta, the limbs carrying it about and ministering to it; while that pinnacle which surmounts it all, represented in the head, but more especially in the brain substance, is the grand objective point toward which nature is bending all her energies. This wonderful harp with its countless strings makes response to the lightest touch of nature and utters tones divinely sweet, or savage and barbaric according to fineness of elaboration and degree of finish.

The configuration of the organ is ovoidal. The outside ovoid is higher evolution of life's form. The law holds good upon extension of the principle, for when the abdomen, or great ventricle, is regarded its form is ovoidal, the great end up, (represented by the incurvated diaphragm,) the small end down, (represented in the pelvic excavation.) The manufacture of blood requires high order of mechanism, hence the necessary evolution of high archetypal configuration in this great territory of the common domain. The lungs are reversal of the figure, their base being down, their apices up. The explanation is in the difference of dignity in their respective labors, with degree of appropriate complexity in their mechanisms. The abdominal viscera manufacture blood, whereas, the lung organs only expose it to the air. They don't manufacture anything, holding anatomical relations only with the leaflets. They afford the necessary contact between atmospheric air and life's juices, with resulting chemical change upon either. Both are interdependent; yet the mechanisms for the manufacture of blood are of higher order than the device for bleaching it. The diagram shows the dilated intestine (stomach) pulled aside to expose the new umbilical vein (portal vein) where it disappears into the liver-substance. The terms are simple —  
A GREAT PLACENTA FOR A GREAT ANIMAL.



Fig. 3 is a photograph of the trunk or placenta of the independent animal. The head crowns this mechanism, whilst the upper extremities are suspended from the auricular appendage of either side in the usual manner.

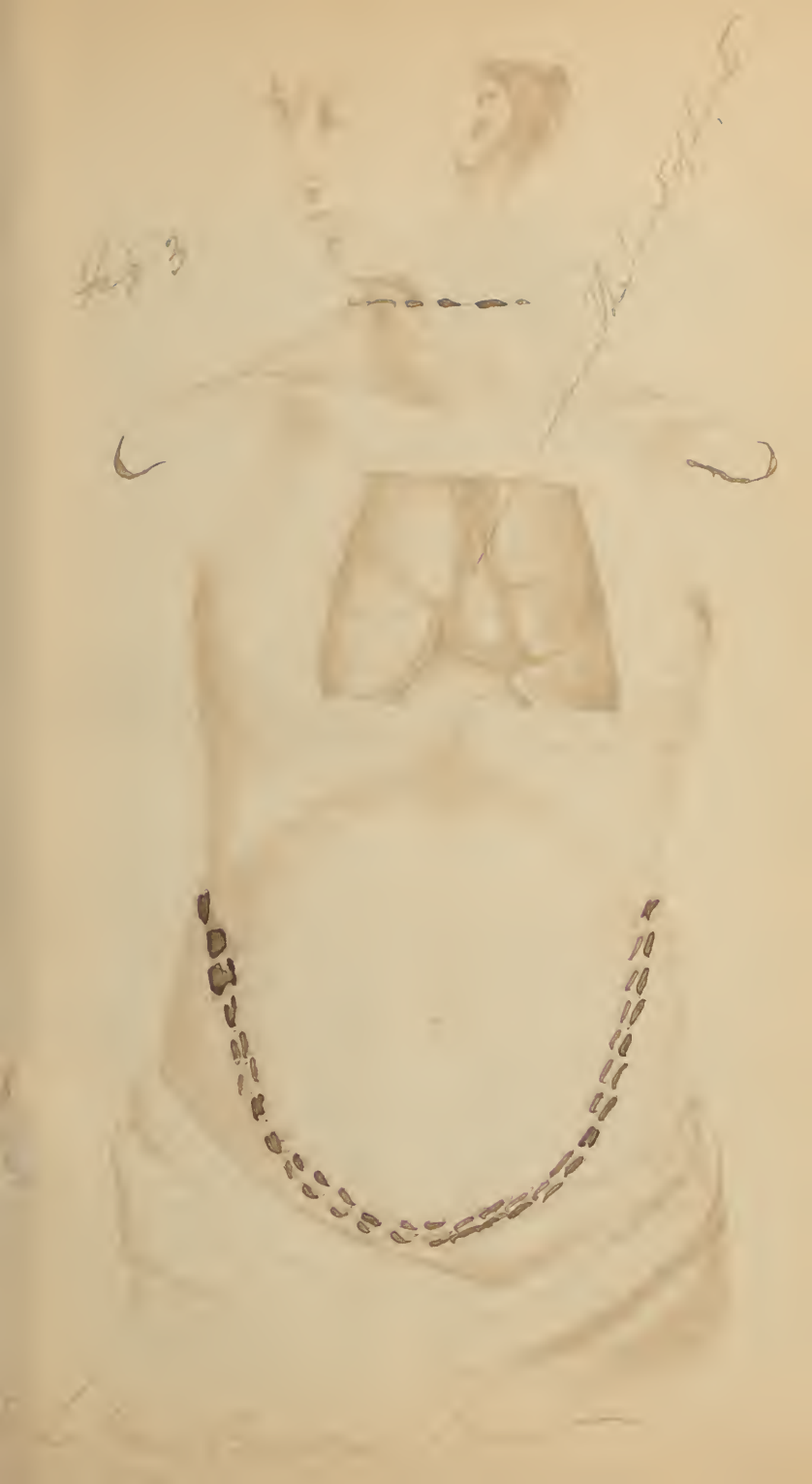
The inferior extremities are not exposed. A window is cut through the auricles at their anterior central portion, in order to exhibit the great elevation of the diaphragm in the chest cavity and the hæmic reservoir, the heart of hearts, suspended by vascular rootlets above it. At each descent of the diaphragm the right side of this reservoir has sudden inrush of blood from the great ventricle below, passing into the tubular apparatus of the great auricles.

At each expiration the left side of the cardiac reservoir receives the blood which had passed into the lung organs during the preceding inspiratory act, having been charged in the interim with oxygen which turns it red. This rhythmic movement of respiration is the analogue of the *soufflé* of the primitive placenta, the net product being the same; i. e., the delivery of oxygenated blood into the central reservoir for general distribution. This great placenta retains every factor of the original one, with specialized mechanical contrivances of a higher order for manufacturing blood and oxygenating it; while the rhythmic expansion and contraction of the trunk aspirates and expels blood into the central reservoir with augmented energy. The terms of the first placenta are fully met and nothing is lost out of the scheme of life. The trunk of animal life has cardiac force to deliver the blood manufactured in its mechanisms into the central reservoir.

Nature deals in fundamental forms, rearing in the midst of all this structure in the first hours of foetal construction, a heart of hearts, as the prototype of the great cardiac temple which is to follow. The body is perfect configuration of the heart in the bosom of this cadaver; the little rose-bud of animal life has perpetuation in life's great temple. The arms removed would allow the auricular projections to extend on either side, as in the little archetype. The head, and life's great petal (the brain) have grown out of the placenta, and should be removed.

At the inferior portion of the trunk the red line is the boundary of the ventricle; what is on the outer side relates to the lower extremities, which are only appendages for carrying it about.

The comparative anatomy has full consideration in the





chapter on *The Heart of Animal Life*. The little heart of hearts acts as a hæmic reservoir for changing the circulation of the blood from the right to the left side, delivering the same into the aorta trunk and arterial mains. This opinion has support in anatomical construction and physiological requirement.

Never for one moment do we lose sight of the ANATOMICAL BASIS, with adjustment to PHYSIOLOGICAL REQUIREMENT, looking from one to the other, then back again, from the former to the latter.

Such reversal is speedy cure of anatomical and physiological misadjustment, of which there is so much in medicine. Nature being required to do impossible things to suit the physiology evolved out of the inner consciousness of men. No misadjustment is in greater degree than that for the circulation of the blood. A tremendous central force, having power to lift up the entire blood-column and pitch it forward into the tissues against the atmospheric pressure and resistance of arterial tubing, is not Nature's mode of performing the circulation, but comes of a rude time of barbaric force and evolved out of the mind of that period, to be supplanted by Nature's kindlier and more gentle method, in perfect harmony with anatomical construction of the vascular apparatus and the delicate corpuscles. Nature's method is much higher order of mechanism than Mr. Harvey's mode for carrying on the circulation.

Look at the location and surroundings of the little heart, hanging by large conduits between two great vascular organs, which have grown up out of it, becoming so large as to envelop it. In the independent animal they aspirate blood from the right side and deliver it into the left side of the heart.

In the work of elaboration something like this happens: the primitive heart is quickly evolved, but slowly and patiently, with great pains-taking, mighty auricles of similar pattern are built over and around them, closing in on all sides, when the rudimental organ becomes no longer visible, the new structure engulfing it in the vast expanse and reach of territory. Whilst these great auricular walls are being constructed most important and interesting transformations are taking place within. Two large and singular looking masses grow up around the rudimental heart, formed of a congeries of compressed tubes. The heart pulsates between these objects which have grown out of it and are fastened to it by large tubular roots, six in

number, counting the bifurcation of an unusually large one as two, otherwise there would be only five rootlets. In the life of the living child these rootlets are called the pulmonary artery and the four pulmonary veins. The two large vascular masses are, in common parlance, the lungs. This whole apparatus, with the fœtal heart suspended between it, is secured to a bony formation at the posterior portion of the auricles (the dorsal vertebra), by means of reduplications of endo-cardial lining called the pleuræ, enlarging the lesson taught in the formation of the valves of the fœtal organ. This endo-cardium envelops all the apparatus so as to give protection and strongest possible support to the delicate mechanism, to ward off the rude force to which animal life is habitually exposed.

At the same time the huge auricles are being built, there is vast design of most curious construction immediately adjacent and contiguous to them, moving at an equal ratio of evolution, yet more complicated in internal mechanisms, in numbers and varieties far exceeding anything to be seen within the auricles. The external configuration is that of the primitive ventricle. The curious looking objects are fastened and secured in similar fashion to what is observed in the auricles. The endo-cardium sends out vast projections and reduplications sufficient to embrace every article and piece of the wonderful apparatus intended for filtration of blood constituents from articles of food, and completely elaborate it, securing them firmly in their place in the posterior wall of the ventricle, some of them being suspended from the arch. This endo-cardium is known as the peritoneum, and notwithstanding the extreme fatality of extensive inflammation to which it is subject, the true cause of death has never been suspected: for instead of paresis of the walls of the ventricle, this deduction was made upon the fœtal heart or force-pump above the real ventricle of animal life.

The filtration of blood takes place into a vast series of capillary tubes, called the portal radicals, sufficiently descriptive for our purpose, and, like streams mountain-born, flow out of the viscera in ever-increasing streamlets, until the whole volume of blood converges in the common trunk of the portal vein. A systole of the great ventricle gently closes on this apparatus of flexible blood tubes, assisting it through the liver capillaries for still higher elaboration by the contrivances in its wonderful machinery, finally empties it into the great trunk of the vena cava, when another systole of the ventricle lifts it up this tube to the little force pump, the auricles assisting in the work;



whence it is dispatched into the pulmonic system of vessels constituting a large part of the beautiful apparatus, for filtration of carbonic gas generated in the blood, and the reception of the last constituent the properly elaborated blood still needs for the sustentation of life (oxygen), which is in like manner filtered from atmospheric air, introduced into the organs by means of a vast mechanism of tubes larger, if not more numerous, than its blood vascular apparatus. There is no escape for the refuse after oxygen filtration, but by the common route of entrance, whence it is pumped out along with the carbonic acid gas. This stream, therefore, is intermitting, and called respiration. But the injection and ejection of air is not all this movement means, but only a part—one of the factors embraced in the act. The blood which is to be filtered of carbonic acid gas and receive a charge of oxygen gas, must flow into and complete the journey of the vascular network during the time of respiratory movement. The time occupied in transporting the blood from the great ventricle through the right side of the central force-pump, to the lungs and utmost system of radicals, is the period of full inspiration; the time occupied in delivering it into the left side of the heart, is the space of time occupied in expiration. The four large short conduits that deliver it into the left auricle is explanation why the expiratory act may be made shorter than the inspiratory. It is not prudent to do this for long periods of time, as in blowing upon wind instruments or running. When all is ready to start the elaborate mechanism, Nature suddenly changes the environment. If there be no error in construction, from a lost link, the beautiful machinery runs at once and becomes a life. If it does run it is not a life, but an incontinent abortion. Independent animal life begins on condition only, of precedent respiratory movement. It is a circulation passing the pulmonary apparatus by the cardiac force only of the trunk itself—being a pulsation of the heart of animal life. If there be imperfection in this mechanism, the whole intra-uterine labor is lost. When it runs after this fashion a full and complete answer is given, how independent animal life is maintained after amputation of the placenta. Respiration is a circulation.

## CHAPTER IV.

### THE HEART OF ANIMAL LIFE.

We have made the statement that the body of animal life is a heart. It has support in the highest order of evidence known to human knowledge: being no less than that furnished in anatomical construction and physiological performance. That the rhythmic movement of the trunk is essential to the circulation of the blood, is fully proven by the prompt arrest of the circulation in the right heart and cava trunks, simultaneously with arrest of respiratory movement. The central hæmic reservoir has not the power to pass blood on through the pulmonic reservoirs to the left side of the heart. This is the office of the great auricles, and when there is impediment of function in them, there is impeded circulation in proportion to extent of pulmonic trouble, and vice versa.

Anatomical construction remains for consideration. The comparative anatomy of the little model, and the great mechanism, is proof positive of their relationship; whilst the physiological experimentations introduced at the close of the anatomical evidence confirming the cardiac power of the trunk, is the end of argument. There is nothing further needed, nor anything remaining to be proven in this respect. To begin with the comparative anatomy, take the circumstance of the relative position of the organs, and the relation of their compartments, with the general configuration. Both are ellipsoidal, the big end up, the small end down. The relative relation of auricles and ventricles is also the same. The former are built over the latter, extending beyond them on either side, and reaching down considerable distance on the lateral aspect. In other words, the auricles form a kind of hood or cap to the ventricles, having ear pieces, which project on either side. Does not the chest sit upon the ventricle of the abdomen in similar fashion, reaching down its lateral aspects, forming the hypochondriac regions? The upper third of the abdomen is in the chest excavation. In the matter of the auricular appendages, do not the acromian processes project out in similar fashion, at the lateral aspect of the

auricles, perpetuating even the shape of the aural curve? There is great fidelity of outline in the two, the model being followed in every particular. They serve to widen the upper or big end of the heart in the archetype and great organ. So far every one of the counts in the prototype has had its tally in that of the trunk of animal life, score for score. Both aspirate, and both expel blood from their cavities by rhythmic movement.

Following up the comparative anatomy, an initial interrogatory would be: How is a heart constructed?

What its FRAME-WORK or SKELETON? It is a hollow muscular organ, built from unyielding rings. The muscular bundles of the left ventricle are suspended from a strong fibrous ring that embraces the root of the aorta. The muscular substance of the right ventricle is similarly disposed around the root of the pulmonary artery.

Briefly stated, a heart is composed of AURICLES, VENTRICLES, MUSCULAR SUBSTANCE and FIBROUS RINGS. Auricles are constructed over rings; ventricles are suspended from rings, with the auricles above them, extending beyond their base of attachment.

Auricles are RESERVOIRS for reception of blood, to be TRANSPORTED TO THE ARTERIAL CIRCULATION. by rhythmic expansion and contraction, with interval of rest. Such are cardinal principles, having appropriate anatomical representation in the two organs.

Where is the firm, unyielding ring to which the muscular substance of the great ventricle is fastened? Answer:—Around the lower chest margin, composed of costal bones and cartilages. It is a solid osteo-cartilagenous sill or beam.

Upon this great analogue God Almighty has founded the temple of animal life. The manner of the curving of this great ring on either side of the xiphoid cartilage, subserves a most useful purpose in chest distastole, also allowing for respiratory compensation in regional disease; at the same time permitting such insertion of the costal cartilages and diaphragm as would result in flaring the chest, and give spring and elasticity to respiratory movement.

This matter has careful consideration when treating of the mode of insertion of the diaphragm and the mechanism of respiration.

The muscular substance of the great ventricle is suspended from this bony ring, and embraces a bony basin at its apex

below. The conical apex to this great ventricle has much marble in its composition, to subserve essential needs in the independent animal. The pelvis is a marble vault built within the apex of the ventricle for the purpose of holding the waste products of blood manufacture in the mechanisms above, as bran from wheat in a merchant mill, fecal matter representing bran, whilst blood represents flour. The excavation is so deep in order to hold the waste products of ten, twelve, or fifteen hours, collecting during this time in rectal and urinal closets. The problem in the sacral promontory is now of easy solution. The vault is pushed or bent backward that the perpendicular axis may have removal from the perpendicular axis of the great ventricle, falling against the umbilical territory instead of striking the middle of the diaphragm. If this were not done, every time he laughed, or coughed, or sung, or made explosive sound, man would have the contents of the closets escaping in his clothes. In the woman with a small sacral promontory the urine often suffers such escape, the sphincter vesicæ not being sufficient to resist the expulsive force above, transmitted from the great ventricle. Man must bend his body forward in order to make adjustment for the bend in the promontory when inclination take him to empty the closets. This is the reason man is the only animal with a sacral promontory. He carries his great heart erect, and in consequence of such change in the position of the ventricle, vital mechanisms must suffer modification, so that when the ventricle contracts in the systole, constringing force sweeps over the pelvic plane, leaving the contents of the pelvic excavation undisturbed. The small intestines, suspended by powerful ligament of endo-cardial lining called the mesentery, sweep over this plane with every contraction of the ventricle, unless specially directed upon the contents of the excavation, when the intestines are crowded and packed into it with greater or less force as occasion may require. The muscular movement of this great organ is subject to voluntary power. More of this presently.

The hinder or inferior extremities are adjusted to deep depressions (acetabula) on the sides of the vault. The object being to enable the animal to move to a convenient spot for feeding or for emptying his closets, which he does according to his habits and elevation in the scale of vital evolution. The highest types of the highest forms elect a china or marble-like basin, similar to his own in water-closets, into which his excrements are discharged and pass out of sight with all the stench



they have, whilst in savagery the individual goes behind his house and performs it upon the ground in an open common, under the public gaze if not admiration. Among quadrupeds there is also difference in this respect. Cows are quite indifferent; cats and dogs are very particular, keeping their little household free of all excrement, especially if of the higher types of the species.

So much for the points of semblance in the anatomical framework or skeleton of the greater and lesser cardiac organs. To complete the comparative anatomy vital mechanics will have to be applied to the disposition of their relative muscular structure. Muscular substance in the archetype is arranged in circular and spiral layers, being the most effective manner for the disposal of muscular force to secure simultaneous shortening of both longitudinal and transverse diameters. Upon superficial examination, the longitudinal greatly diminishes, whilst the transverse diameter seems to lengthen during the systole. This is, however, the result of thickened muscular substance, and not at the expense of ventricular area, since its transverse axis is undoubtedly shortened in an equal ratio with the longitudinal; otherwise the effort of the ventricle to empty itself would be abortive. How are the muscles of the great ventricle disposed so as to similarly qualify it to perform its appropriate labor? Answer:—The disposition of its muscular force is perfect. To economize time, as also to render the labor of description more effective, attention is directed to the following wood cuts in Mr. Quain's Anatomical Plates: Plate 27, page 51, Figs. 1, 2, 3, 4, 5, showing the position of the diaphragm and cavity of the ventricle.

The following wood cuts, in Mr. Wilson, Fig. 114, and Mr. Gray, Fig. 160, and Plates 26 and 40, Mr. Quain, are exhibit of the chief muscular substance in the walls of the great auricles.

The manner muscular substance of the auricles is disposed upon the walls of these organs, and the mode of motion in them will be fully considered after treating of the ventricle, it being necessary to do so for full appreciation of auricular movement, which is propagated from the ventricular side. The matter is therefore delayed for the present, for more correct interpretation from a higher point of observation. We reverse the outlook upon respiration, regarding it from below, looking through the eye-piece of the telescope, which is the proper method; the other is the objective end of the instru-



ment. The fashion has been to look into the big end downward. Life is the loftiest object in the firmament of science, hence the intellect should make use of the eye-piece, and it will see more of life's mysteries and life's expanse.

The diaphragm is ballooned high in the chest excavation, formed by the bony frame-work of the ribs, with the dorsal column behind and the sternum in front. Upon the right side its elevation corresponds to the fifth rib in front; on the opposite side it is about one inch lower, corresponding with the sixth rib. The periphery of the diaphragm is firmly fastened around the entire inferior margin of the chest-walls, terminating posteriorly in two powerful cables, (*crura*), securely anchored to the lumbar vertebræ. The interval between the twelfth rib and the lumbar vertebræ is spanned by two large loops of transversalis fascia, the *ligamentum arcuatum externum* and *internum*. They bridge over the substance of the *quadratus lumborum* and *psoæ* muscles.

Muscular fibres in the diaphragm extend from the ring upward perpendicularly. When they contract the arch or vault of the organ must necessarily approach the plane of the ring. In other words, this great muscular leaflet makes attempt to straighten out its curve upon the plane of attachment in the costal ring, moving toward this plane during inspiration.

Attention is called to Plate 26, Quain's *Anatomical Plates*, showing the posterior wall of the ventricle. The posterior wall is built up by the two *quadrati lumborum*, one on either side, and the two *psoæ* muscles. The former are securely fastened above along the entire extent of the inferior rib, firmly holding this portion of the ring; their inferior attachment being into several transverse processes of the lumbar vertebræ, the *ilio-lumbar ligament*, and the posterior portion of the crest of the ilium. The two *psoæ* muscles, one on either side of the spinal column, complete this portion of the muscular envelope.

They do important service in progression, passing out under *Poupart's ligament* for insertion into the ~~former~~. The limb is advanced under the trunk by its contraction in quadrupeds. In bipeds the thigh is flexed upon the abdomen, but the action is the same as in the former; it simply shortens the distance between the points of attachment in the lumbar vertebræ and thigh bone.

Attention is now directed to Fig. 117, *System Human Anatomy*, by Erasmus Wilson, M. D.; also, Mr Grey, Page 285, Fig. 165, and to Plate 24, Mr. Quain.

The transversales muscles are now in place, and complete this layer of the muscular envelope or inner wall of the ventricle. Notice their extensive attachments and the disposition of their fibres: they form the circular muscular substance of the ventricle. When these contract they shorten the transverse axis. Their upper insertion is by muscular inter-digitations, with those of the diaphragm, along the entire border of the inferior ribs on the inner aspect of the costal ring, the other points of insertion of the muscular substance of the lateral walls being upon the external aspect of the ring. The rectus abdominis on either side of the mesial line secure this portion of the ring against sudden traction made upon it, as in blowing or in singing or in efforts made in climbing, lifting the body by the upper extremities. In any of these exercises, these muscles become rigid in the necessary labor to hold down the ring. For the more effectual performance of this office, their upper extremities are divided into three muscular bundles, to secure the widest possible insertion over the surface of the central portion of the ring: being into the 5th, 6th and 7th costal cartilages. The inferior extremities of the recti are fastened into the pubic bone. Attention is called to figure 164, Mr. Gray's Anatomy; and plate 23, Mr. Quain's Anatomical Plates, showing the middle muscular layer of the ventricle.

The internal obliques are now in place. We feel it to be unnecessary to give the minute anatomy in description of the ventricle, the object being only to show the disposition of the muscular layers. It does not require tiresome detail of the fasciæ leaflets, serving, as they do, to afford firm attachment to muscular bundles. This is the office of works on descriptive anatomy. When the muscular fibres of the internal obliques contract, the result will be (from their insertion into the lateral and anterior portions of the ring) to draw this portion downward and backward, toward the iliac crest, being the point of origin for its powerful muscular bundles; by reason of their fibrous apponeurosis covering the central portions of the ventricle, its transverse axis will be proportionately affected, thereby augmenting the power of the transversales. Attention is directed to Fig. 163, Mr. Gray, and to Plate 21 and 22, Mr. Quain's Anatomical Plates, completing the cortical layers of the trunk. These pictures represent the entire muscular envelope of the heart. We would have preferred a picture representing the muscular substance of the ventricle,

by itself, but defer it to another time, when one may be made. Firm contraction of the muscular substance in the external obliques would have the effect of drawing down and approximating the posterior half of the ring toward the pelvic basin, bending the body forward, shortening the long axis, and greatly reducing the area of the ventricle.

This completes the muscular arrangement in the ventricular walls for the performance of systolic action. The nervous supply is from the spinal cord, from the third cervical to the twelfth dorsal or intercostal nerves.

The manner of arrangement of the muscular substance over the cardiac wall, occasions a systole of the ventricle synchronously, with diastole of the auricles. It can not possibly do otherwise, from the nature of the mechanism, as will be presently shown. The question is one purely of leverage, and not of difference of muscular substance or of nerve-supply.

Muscular behavior is uniform under a given amount of nervous force. The common nervous supply to auricles and ventricle, is by the intercostal nerves.

An electric current passing over these nerves, condenses muscular substance upon the walls of the chest and abdomen at the same instant. It can not be otherwise; they extend through the intercostal spaces to the walls of the abdomen, the ribs being the rods of support to the wires, (or of the muscular substance in which they are imbedded), and conduct them to the muscular substance of the abdomen. An electric current is therefore felt upon all this territory at one time.

So, then, the matter may be very readily understood, how one region may contract and another dilate, if suitable arrangement be made in adjustment of the leverage, the muscular energy being the same in both localities, according to quantity of muscular substance—being more energetic where it is more abundant.

The base of the ventricle (diaphragm) has first connexion with the cord, tapping the main line through the phrenic wires, in the upper cervical region. This is the reason respiratory movement begins in the diaphragm, and has gradual extension over the outer walls. It is also reason for the manner respiratory movement may suffer modification by voluntary power; and why eating, singing, talking, screaming and laughing may be performed at will—explosive force having direction toward the outlets of the body through modification of muscular movement in the walls of the ventricle.

Were it not for VOLUNTARY CONTROL over the great cardiac pulsations, such vital phenomena would never happen, nor animal life continue. The animal can not pass substances down the œsophagus unless it had the power to relax the ventricle, that they may drop into it, when peristaltic action passes them to the cardiac orifice; articles are not put into a fist or closed hand, but into an open one. The ventricle opens during deglutition, and when the animal swallows, respiratory movement must halt peremptorily. This is the explanation of relaxation of the diaphragm, with circular movement of the œsophagus, after section of the pneumogastrics with irritation of the proximal end of superior laryngeal nerve.

Apoplectics starve. Animals survive eight to ten day's starvation. This class of patients survive this long, if the cerebral hemorrhage be not sufficient to destroy life in the earlier stages. Death by starvation is a common termination of this kind of injury.

## MUSCULAR MOVEMENT IN THE WALLS OF THE VENTRICLE.

In order to bring out in relief the muscular power and function of the great ventricle, and thereby effect a clear mental picture of cardiac movement, description of its powerful muscular envelope will be given in detail, beginning with the fundus formed by the incurvated diaphragm.

### THE DIAPHRAGM.

Muscular energy in the ventricle, is the chief force to respiratory function—therefore the point of great activity—for there is such pivotal point to respiratory energy. The force of respiration is focused upon the muscular floor of the chest, the culmination of its energy being in the powerful vibratory movement of this most remarkable organ. And for proper appreciation of its performances, it is absolutely essential that we have before us the bony skeleton of the chest-walls, to observe the mode of their construction and the manner the diaphragm is fastened into them. The mechanism is beautiful in the extreme, and worthy the best effort of the intellect for that high appreciation it so well deserves. Study the mode of construction of the ribs, with cartilagenous fastenings in front,



combining strength with elasticity, where bone alone would be inflexible and hurtful: as, also, the degree of costal inclination to the dorsal column, and the very firm mode of fastening at this point, giving great solidity to the respiratory skeleton. After observing all this mechanism critically, make equal careful inspection of the manner the diaphragm is ballooned into it, and the points of its fastenings; also, the general relation of the two, with the object of forming an intelligent opinion as to the probable result of diaphragmatic movement upon this position, and the kind of motion it would impart to the costal frame-work. For it is the manner of ascent nature makes to the mammalian elevation, and solution of the problem of respiration in them. Look at Fig. 5, Plate 27, Mr. Quain's Anatomical Plates.

The inclination of the costal bones is below the horizontal line of the dorsal perpendicular, progressively increasing from the fifth costal bone down, each one of these representing the horizontal leg of a distinct dorsal triangle. On the other hand, the seven ribs on either side undergo progressive retrenchment, till in the twelfth, the shortening becomes so great the bone does not measure one-half the length of the last true rib.

This shortening takes place upon a line extending from the third lumbar vertebræ to the lower portion of the sternum. This oblique line is represented by the elastic beam of cartilagenous substance, which receives the ends of the costal cartilages, holding them fast in their places, at regular intervals. The interval between the costal bones is occupied by two layers of short, muscular fibres, that cross each other at an acute angle, known as the "external" and "internal" intercostal muscles — the intercostal arteries and nerves running between them. The diaphragm acts upon this cartilagenous beam from the inside, when it begins its descent, the viscera pressing against it under about four hundred square inches of atmospheric pressure; this is to be overcome before a vacuum area can be formed at the base of the lungs. By reason of its high ballooning, it exerts great traction force in pulling itself out of the chest-excavation, which is felt upon the ends of the seven inferior ribs. The utility of this arrangement is two-fold. 1st. By pulling upon the long axis of the costal bones, traction force has greater solidity than if it pulled transversely against the intercostal muscles. 2d. By pulling against the ends of the costal bones, it bends them, and flares them open at the sides and middle — being arched and elastic. Their elasticity is in-



creased, at the terminal extremity in front, by cartilaginous splicing, extending from them to the cartilaginous beam or ring of the ventricle. If one pull upon the end of a flexible bow with sufficient force it is bound to spring at the more flexible portion, first, extending to other firmer portions, with increase of the energy. This is the explanation of respiratory movement. The manner of costal articulation with the dorsal vertebræ is such that when the bones undergo the bending of inspiratory movement, they are rolled outward and upward. In other words, the manner the diaphragm pulls against their extremities causes the ribs to twist upon their long axis, at the same time increasing their curvature and occasioning the widest possible expansion at the lower lung regions, corresponding with their base.

By such arrangement respiratory movement is made elastic, and being operated from below, necessity does not exist for muscular substance upon the chest walls for respiratory purposes; a fact we propose to prove by physiological experimentation of dissecting off the external chest muscles, leaving respiratory movement unimpaired. When the flaring takes place by bending of the bony arches, the inter-costals regulate the distances or intervals between the costal bones.

But on special occasion muscular substance upon the chest can be made operative to a degree for chest expansion, as will be shown later on, and the manner it is done.

The curving of the cartilaginous ring in front, on either side of the xiphoid cartilage, leaving a V shaped interval, is provision for extension of the costal bows when the diaphragm relaxes. Interest in the latter organ is not diminished by comparison with the device of the costal mechanism in which it works and performs such great role in life's drama.

Its shape is ovoidal, and for the purposes of description is resolvable into three leaflets; the central or cordiform one, though small as compared with the one on either side, is nevertheless the point of greatest interest. The pericardium is fastened to this portion, whilst the aorta, vena cava, and œsophagus pass through its territory.

If a flatish apple be held by the stem, and a section one-eighth of an inch thick be made through it on either side, the slice will not be bad imitation of the diaphragm. The core and seed pocket represent the cordiform territory, with its heart and pericardium; the terminal blossom and the sides represent the crura and the lateral leaflets. Life's form grows out of

this seed bed. The diaphragm sustains the relation of constituting the oscillating floor to the respiratory apparatus, at the same time forming the vibrating ceiling to the abdomen or great ventricle, whose viscera under atmospheric pressure carry it high up into the chest excavation, where it is found after death, tense from distention. The effect of contraction is to momentarily withdraw itself from the depths to which it had been carried, coming nearer the lower chest line. This act constitutes **INSPIRATION**. Its relaxation and retreat under atmospheric pressure, into the deeper chest regions again, constitutes **EXPIRATION**. The sudden lowering of the pleural floor in the former, produces the pulmonic vacuum, whilst the compression force of the latter aids in expressing out the air again through the same roadway by which it had rushed into the vacuum areas. This, with a little flaring movement of the lower ribs, is the whole extra pulmonic performance in ordinary respiration; the movement taking place in the lateral walls of the ventricle, having reference to the vascular apparatus of the abdomen chiefly, though contributing an item in the firmer fixation of the costal ring, even in this quiet form of respiratory movement. The more energetic action in the abdominal walls occurs during active movements of the animal; when blood must be dismissed rapidly out of the great ventricle, respiratory movement has proportionate increase. The pleuræ occupy the whole upper surface and sides down to the point of insertion into the costal ring, with exception of the pericardial territory. It follows that in the act of withdrawal of the diaphragm during inspiration, the **BASE** of the lungs is included in the vacuum. This is quite enough for ordinary respiration,

The central portion of the diaphragm, or middle leaflet, has less muscular fringe than the right and left leaflets, and in consequence, this cordiform territory is comparatively quiet. The reason for such arrangement is to save cardiac oscillation, since the pericardium being firmly fastened to it and to the arterial mains above, traction force would be immediately felt in a cardiac jerk, the anterior and posterior fastenings of the pericardium not being sufficient to prevent it. The ascending cava takes advantage of this eddy in the undulating plane to effect entrance to the pericardium and right auricle.

The character of this venous lumen is worthy of notice; it differs so notably from the œsophageal opening several inches to the left of it. It is a permanent and nearly circular lumen,

destitute of muscular fibre; whereas, the latter is an ellipse, formed of strong muscular bundles, which must inevitably constrict the œsophagus in powerful movements of the organ, as in running and jumping, screaming and laughter, when it is highly probable an important office is to aid the sphincter muscle of the cardiac orifice to retain the ingesta. The same muscular bundles embrace the aorta trunk between their tendons before insertion into the lumbar vertebræ and compress it with every inspiratory movement, as I have repeatedly demonstrated by physiological experimentations, some of which are reported further on.

The permanent vena cava opening, as also the permanent hepatic openings into the cava trunk, are to facilitate onward movement of the blood, occasioned by the great cardiac pulsation. The gall bladder is subject to pressure also, and the juice expressed through its discharging duct into the duodenum. If movement of the ventricle be arrested it becomes enormously distended in twenty-four hours, as I have proven experimentally over and over again.

For full appreciation of the perfection of the muscular apparatus of the abdominal excavation, a cat should be chloroformed and a section taken out of the adjacent abdominal walls and costal ring, including a portion of the diaphragm. When the peritoneal surface is exposed, one cannot for the life of him tell where the line of distinction is between the transversalis muscle and the diaphragm; and only by closely following separate muscular fibres with some pains-taking can it be done at all, the whole matter having such strong semblance to the walls of a continuous muscular ventricle. The diaphragm acts as a great detrusor muscle of the abdomen in expulsive effort. When the systole is fully organized by corresponding movement in the lateral walls, the pelvic excavation is filled to repletion by the movable viscera forced into it, (the small intestines and omentum); and what collection there may be in the bladder, in the rectum, and in the womb, will be subject to a great amount of pressure, and may be driven out of the body even against one's will, for the sphincters may yield under the force. Its habitual participation in the act of defecation is in the common experience. Its effectiveness in the later stages of parturition one should not deny who would have his opinion respected.

A most important circumstance, not hitherto noticed, is COMPRESSION of the aorta trunk AT THE CRURAL

OPENING during each inspiratory act, the degree of compression force having regulation by the energy of diaphragmatic contraction. When inspiration is deepest it is greatest, and vice versa. The right crus forms an arc or bow over the artery, and when the muscular bundles shorten during inspiration, the bow straightens out between its extremities or points of attachment, pushing the vessel in consequence AGAINST THE OPPOSITE CRUS.

Fig. 4 is a photograph of the diaphragm, from Mr. Gray. For experiment let a ruler be placed so as to rest upon the upper origin of the right crus, at the tendinous center, and upon its point of insertion into the third lumbar vertebra. The ruler will cover up the lumen of the aorta; hence energetic contraction of the muscle would have the effect to occlude the aorta trunk. During inspiration blood comes to a rest at the crural flood-gate, whilst the heart continuing to beat as usual it accumulates in the upper portion of the aorta, climbing up through the internal carotids and vertebrales to their relative brain territory, passing through bony canals and supplying the nerve substance by gentlest irrigation. Brain substance (the vesicular matter) is four-fifths water, and it is not capable of withstanding the thumping of arteries and the forcible injection of blood, as in the common method. Blood reaches the brain substance through long bony tunnels by most devious passage.

The cerebral circulation is unique. When its substance is incised, there is no jet or spurting of blood from the divided vessels, but a constant flowing, marked by a diminution at each inspiration from sudden out-rush at the base through the wide jugular canals, which takes place at this time.

Physiological experimentations are given corroborating the above.

#### MUSCULAR MOVEMENT IN THE LATERAL WALLS OF THE VENTRICLE.

It is with unmixed pleasure we contemplate the exalted mechanism Nature has elaborated in this large territory of the animal organism. The wonderful perfection of a scheme having several paramount objects to be attained, where failure in one would result in common ruin, is measure of exalted genius, well calculated to inspire the beholder with a feeling of awe and reverence; it may be for the first time in his life. The





Fig 21



Whisper

intricate and delicate mechanisms for the elaboration of blood, need support and protection against injurious compression ; yet, an amount of compression is absolutely essential to the systemic and portal circulations. At the same time, the interests of respiration must be subserved without entailing injury upon these functions. Moreover, suitable modification, to be made in the female, for lodgment of the fruit of the womb, in addition to the waste materials left from blood manufacture.

All these varied interests, having appropriate mechanisms, performing without collision under one roof, in one compartment, the mobility of whose walls alone is fraught with peril, offer a problem in vital mechanics without rival. A ventricle containing all these mechanisms, must have construction, whose systole will not be fatal. The corner-stone of anatomical construction is furnished in the principle of muscular contraction ; when muscles contract, they shorten in the direction of their origin and insertion. Applied to the construction of the great ventricle, we observe the following arrangement of the muscular substance of its walls. The upper attachment is around the border of the inferior ribs ; the lower insertion is around the pelvic rim.

When contraction sets in during the systole, it would therefore occur on a plane between said origin and insertion ; the more energetic the muscular condensation, the nearer an approach to a horizontal line in the plane. Compression must, therefore, take place by effort to compress the viscera within this plane. The distance between the lateral walls effected by insertion into a bony ring above and below, is estoppel of the systole, and arrest of compression from muscular force, though atmospheric pressure is still operative. The energy of this latter force is well exemplified in cases of emaciation, in which such shrinkage in the volume of the viscera takes place, as to bring them within the muscular plane of the ventricle ; when atmospheric pressure, continuing as active as ever, the plane is bent backward against the viscera, in degree with the visceral shrinkage, causing that incurvated appearance under the ribs, extending to other portions of abdominal surface characteristic of this condition. Hunters, after a several days run, lose the abdominal rotundity with which they started, becoming lank and hollow from loss of visceral fat, given for the generation of running force.

Muscular energy being equal, ventricular compression is

most effective upon a line anterior to the plane, hence hernial protrusions result to this class of persons. The viscera are so forcibly compressed, the movable parts burst through the less protected portions of the walls, escaping at the inguinal and umbilical regions. In the female, the pelvic ring is made wider, to allow for uterine expansion; but when she is so unfortunate as to have a more narrow (male-like) pelvic rim, she must be habitually upon her guard during gestation, keeping as quiet as possible, more especially must energetic movement be inhibited, as in mounting stairs, since the systolic force necessary to support the blood column upon the brain mass, to enable it to perform such energetic action, would endanger miscarriage.

This is the secret of such accidents. The obstetrician has long acquired the habit of shaking his finger at the woman with a gravid womb, in emphatic warning against climbing stairways. The wider the pelvic rim, however, the greater degree of exemption from such "accident," premising the absence of uterine disease. But such modification of the pelvic rim, is strongest obstacle to that measure of physical energy in the lower extremities witnessed in the male, and cause of that "pain in the side," of which she complains so much, produced by traction and pressure upon terminal twigs of intercostal nerves, located about the region of the ring; when the strong muscular substance of the ventricle suffers unusual condensation, as in deep inspiration, in "sighing," or the still more frequently repeated traction force exerted in running; at such time, the pelvic muscles have strong tendency to flare open the upper ring, till it correspond to its own muscular plane of the pelvic circumference. If energetic movement continue after the "stitch in the side" is felt, it will soon extend all through the ring. The man with a wide pelvis can not run well, and he need not try it more than once. Women even aggravate this trouble, by bending the costal ring still further inward, by tight lacing, and compressing bands in their petticoats and outer-dress. Hence, they sigh oftener after dinner, especially if they lead a sedentary life (sewing), which interferes with respiratory action: for the "sigh" is but compensatory movement for restricted lung-base, whilst the greater pain endured is proper penalty exacted for violated law.

Let them relax the energy of the lacings, if they would desire abatement of the pain. They should be more moderate in cultivating deformity. The soil to this spontaneous growth

in distortion, exists in male prejudice, to which the female ever panders.

The Chinese woman works upon her foot; a small, deformed foot is her delight. But the Caucasian rejoices in a "small waist." The greater mobility in the upper chest-walls, is nature's compensation for the foul imprisonment of the lung-base, so long indulged, and so persistently carried out, over the model of artistic taste. And, since the higher types of the male species prefer the hips to appear full and round, and the feet a little larger than the Chinese woman's, it does not appear very probable, the absurd custom of over lacing the waist with corsets, and the feet with tight-fitting shoes, will be discontinued soon.

The trunk of animal life is in two great pieces: a broad upper one and a long lower piece, which telescopes the upper piece. Respiration must be viewed from below upward—the eye-piece is toward the ground. It is a **GLIDING IN AND GLIDING OUT MOVEMENT**, of the lower piece into the upper one, piston fashion.

Respiratory movement is energized in this manner, viz.:

1. The electric current from the cord strikes the phrenic nerves, being the first given off by the trunkal line. The movement, therefore, begins in the diaphragm.

2. The electric current continuing down the cord, passes into the twelve dorsal nerves, or the twelve pairs of intercostals, the wave-like movement extending over them from above downward, and from within outward. The twelve pairs of dorsal nerves are the common nervous supply to the chest-surface and abdominal walls. When muscular substance condenses under them in respiratory movement, it is, therefore, simultaneous over both localities. The result is dependent upon the manner of the disposition of the muscular substance, the whole matter being one of leverage simply.

The condensation over the chest-walls of muscular bundles operative for chest-expansion, causes upward traction upon the costal bones and cartilages, with upward movement as the result of inspiratory act, the diaphragm being the potential cause.

At the instant this is taking place, there is synchronous movement through the muscular bundles of the abdominal walls, the result of such condensation being to approximate their points of origin and insertion; they straighten out upon their plane of attachment; the diaphragm coming down all

the time of this lateral movement (piston-fashion,) over the mouth of the muscular barrel of the abdomen. The more energetic the inspiratory movement, the greater its descent, and straighter the sides of the barrel.

The diaphragm is ballooned high into the chest-excavation, in close apposition with the base of the lungs (the thickness of the pleuræ intervening,) and initiates respiratory movement, by condensing itself upon the ring of insertion, which would remove it from the lung-base, did not their alveolæ suffer atmospheric distension from inrush of air, in exact ratio to the downward movement, keeping the lung-substance upon the diaphragm all the time.

No divorcement takes place between them. The lungs ever follow the diaphragm, and ever submit to it. Both are mutually inter-dependent. The problem is in formation of the vacuum. To effect this, the diaphragm must pull itself out of the deep portions of the chest, with the abdominal viscera upon its breast, opposing it, and about four hundred inches of atmospheric pressure upon them in addition.

It performs tremendous labor to accomplish this result; and if it had all to be done on the instant, it would utterly fail. On the contrary, only a portion has to be done at a time, whilst the conquered territory in the vacuum areas is as rapidly occupied by its atmospheric ally, which comes into the open province from the rear, and firmly holds what has been acquired by the diaphragm, keeping steady pace with its advancing lines, till all the territory is occupied, and inspiration accomplished. Still, great traction force necessarily falls upon the ring during this performance, in order to form a vacuum of small extent even, since the viscera, and several thousand pounds of atmospheric pressure must be first pried up a little way at a time. Atmospheric pressure from the lung surface is only one of occupation; it does not more than occupy what has been taken by previous movement of the diaphragm. It simply follows it, and holds possession of what is taken in the forward movement of the force in front of it. Under cerebral stimulus, traction energy so exerted upon the ring of the ventricle, through the diaphragm, would be sufficient to roll it inward and upward into the chest-cavity, if provision had not been made to interdict the movement, by timely contraction of the recti, and the two pairs of oblique muscles, acting from the firm anchorage of the pelvic basin.

To have some appreciation of the voluntary power in the



diaphragm, or rather its measure of energy under voluntary stimulus, make use of the following experiment, viz.:

Place one hand upon the surface of the abdomen, and make firm pressure, with the object of ascertaining what is taking place under it, at the same time firmly compress the nares with the thumb and fore-finger of the other hand, with the object of inhibiting any ingress of air into the lungs, keeping the lips compressed against each other with the same intent. After all is ready, make strong effort to inspire. The diaphragm makes prodigious efforts to force down the viscera, by pulling itself out of the chest cavity, but the abdominal muscles are prompt to the rescue and support of the osteo-cartilaginous ring, upon which the diaphragm is pulling, opposing the upward movement with such force as to render them hard and iron-like, under the firmness of their contraction. The experiment is readily made through the clothing. Has wrong interpretation been placed upon this strong muscular movement? By all means let the true one be given. What is nature attempting to perform with such expenditure of nerve-force, and muscular energy, in this locality, at this particular time? What does animal life stand so much in need of at this juncture of its affairs? Whatever that is, will be appropriate answer to this interrogatory. But, remove the pressure from the nose and mouth, and air will rush into the vacuum, at the lung-base, instantaneously, with simultaneous abatement of muscular energy in the walls of the abdomen. Is the latter not dependent upon the former? Is the relation not one of cause and effect? Would the latter ever happen with the former in abeyance? The diaphragm can make but partial descent in the absence of its ally of occupation, furnished in fresh pulmonic air. What other law would explain muscular energy in such degree of exaltation in the walls of the abdomen, at this special crisis in respiratory want, than the one to which reference is made? In other words, it is the measure of diaphragmatic force, and exact ratio with it, in the hardening of the muscular substance of the lateral walls, which holds the ring. During ordinary respiration, muscular energy over the external walls of the abdomen is greatly reduced, so much not being necessary to make the needed compression upon the vascular tubing it contains, to empty their contents into the ascending cava, and express the lymphatic juice through its system of vessels. Besides, compression force must have regulation on account of the heart itself; if too

great, it may rupture it, else the lung capillaries, as frequently happens in racing.

*acid* In normal respiration, the diaphragm gradually, but only partially, extrudes the viscera out of the chest excavation, causing them to appear under the softer abdominal walls, which being still ~~flexed~~ and relaxed from the previous diastole, receive a wave-like motion upon the visceral approach, and are lifted up by the strong under-current; when resistance sets in at once through all this territory, increasing every moment to completion of inspiratory movement, being greatest at its acme. Because this energy is evolved after diaphragmatic action sets in, is no reason for depreciating it, the movement being essential to later stages of lung expansion, and the circulation of the blood. The blood throughout all the vascular tubing, in the great cavity of the abdomen, is caught between the two contending forces in the diaphragm and abdominal walls, and driven out of this great ventricle; the energy of the movement being dependent upon degree of vigor of the systole.

That this is true, is fully borne out in cases of sudden death occurring at the height of this energy, as in running the race horse, or in overloading the draught horse. These cases do not perish from lung obstruction, from inability to expand their alveolæ, with corresponding blood-delay in the right chambers of the heart; on the contrary, its vascular apparatus is over-full of blood, and, in consequence, receives the largest amount of areation possible, as is fully proven by the ARTERIAL HEMORRHAGE, that takes place in the rushing torrent escaping by the mouth and nostrils. The fault is not in the LUNG-ORGANS—their mechanism may be perfect, and most ample—but in TOO GREAT ARRIVAL OF BLOOD. The blood can not go into the left chambers, already full, nor is it permitted to return into the right heart—the semi-lunar valves interdicting. The only mode is to either burst the capillaries, else burst the heart. In obesity, or fatty metamorphosis of its muscular structure, the right ventricle is very liable to give way under this kind of strain. If it happen to the left side, dyspnœa will precede rupture of the ventricle from pulmonary blood-stasis. The too rapid delivery of blood under the powerful pressure of the great ventricle, may, therefore, either result in bursting one of the little ventricles above, or the lung capillaries. Venous blood from the head and neck, straight-out, as the latter are in racing,

could not do it, since the venous blood-column inclines to a straight line with the heart. The heart is broken by injection from behind, from which there is no escape. The blood in the portal veins and in the cava-trunk, in racing, is subject to great pressure.

The abdomen forms a muscular barrel, with projecting ends, the lower one comprising the pelvic basin, the larger upper one extending into the chest, and covered by the diaphragm, which is fastened around its rim. The sides are flexible and yielding, with a stiff section in it, represented by the spine. It is constantly full, but alters its area by rhythmic contraction and expansion. During diastole, it is greatest, at which time the arch of the diaphragm is at its highest elevation in the chest cavity. When the upper piece, or incurvated head, begins to condense itself and straighten out horizontally over the head-line or rim, it forces the subjacent viscera down into the barrel, the sides of which, feeling the stimulus, begin at once to condense themselves also, and, under the combined pressure of this augmenting force—which is greatest at the height of inspiration—the contained fluids in the vascular apparatus, including the lymphatic juice, escape through the diaphragm, the glandular organs discharging their contents at the same time: a circumstance readily proven by physiological experimentation of dividing the walls crucially, else paralyzing them by destruction of the spinal marrow as high as the sixth dorsal vertebra; in which event, there is arrest of urinary secretion, whilst the gall bladder is full to bursting within twenty-four hours, the space of time the animal may survive.

There can be no mistake in this matter. The diaphragm descends upon, and acts as a piston in a muscular well, which narrows on its approach, to confine the contents, and prevent escape of fluids in any other direction than that through the piston and secretory outlets.

Hence, when the diaphragm is down nearly upon the top of the well, as in energetic inspiration, its plane is nearly ~~horizontal~~ <sup>perpendicular</sup> to the muscular plane of the well. A section would, therefore, represent the letter L, inverted.

The mistake of interpretation of muscular behavior in respiratory movement of the abdomen, is mainly attributable to the earlier portions of the inspiratory act; at this time the muscular barrel is relaxed, and the piston of the diaphragm coming down just after this relaxation of diastole has taken place, causes a wave-like movement, sight entirely being lost of the

+ at right angle

instantaneous contraction setting in over the crest of the wave, bearing it down and holding it so it go no further, which is caused by the barrel straightening its sides.

I have seen this performance go on with the left side of the chest opened so as to expose the incurvated piston of the diaphragm, descending as if to go into the barrel, then stop and come back again, having finished the movement of inspiration. Have seen it repeat this performance again and again; moreover, had the animal to revive, with the left lung collapsed, and the heart exposed. The diaphragm, therefore, went down toward the mouth of the muscular barrel as its own act, and part of the respiratory performance, to meet response and co-helpers in the full act later in the performance of life's drama of respiration. If this last actor fail, there is speedy end of respiration and of life. Death results from anæmia of the brain, from non-arrival of blood out of the great ventricle. The co-ordination of movement in the perpendicular walls of the ventricle, with that of the diaphragm, has confirmation by physiological experimentation, corroborating the auto-physiological experimentation of the aborted respiration, advised above. There are several methods of doing this, which are quite satisfactory in their results, placing the matter beyond controversy; not leaving room for doubt. Vivisection settles it.

The object being, of course, to see whether blood will continue to accumulate in the ventricle, till the animal perish from cerebral anæmia, in consequence of such blood-diversion. It is no small circumstance, that after these operations, the animal keeps perfectly quiet, and all the great activities in abeyance; since it is especially for their performance great energy is needed in the ventricle, to keep the arterial circulation full, especially that of the brain-substance. Whereas, in the very quiet condition of torpor, no such tension exists.

Nevertheless, the animal can not save its life, and it dies of cerebral anæmia, from blood-diversion in the vascular apparatus in the great ventricle, the requisite force not being present to expel it.

The piston of the diaphragm acts as usual, moving even more energetically; but the muscular barrel is now only a bag, passive, unresisting, no longer opposing the downward movement; and the contained juices ooze out and around in every direction. At death from extensive peritonitis, the peritoneal sac is full of hæmic juice; whilst the systemic vessels



are nearly empty; the blood diversion being gradual life continues until the general anæmia is complete. Had paresis of the muscular walls been less gradual, death would have had corresponding acceleration, with less amount of oozing; the vessels containing sufficient blood to destroy life before much oozing can take place.

If the ventricle be divided crucially by an incision extending from the middle of the quadratus lumborum to a corresponding point on the opposite side, and one from the ziphoid cartilage to the pubes, death speedily follows; taking place in some instances in a few minutes, in others life continues for an hour or such matter, the time varying somewhat.

Death results from anæmia of the brain, the blood having accumulated below the diaphragm.

With this revelation many unexplained circumstances in clinical experience, embracing some in physiology and anatomy, have ready explanation given them. Syncope following paracentesis abdominis, or from parturition, is due to sudden loss of support to the blood column in this great cavity, the relaxed abdominal wall not having had time to condense themselves after removal of the contents which had distended them. The operation of ovariectomy does not disprove the ventricular character of the abdomen, as no muscles are divided, the recti being only separated to a limited extent. The patient is carefully bound up with bandage and padded with cotton wool. In this class of cases death is more rapid than in ordinary peritonitis, by reason of traumatic injury to the great nerve plexuses, with resulting vascular paralysis which it occasions, and consequent more rapid withdrawal of blood from the systemic circulation. The rupture of adhesions over the parietal surface are comparatively free of danger, but it is far otherwise with those over the viscera, for this is the territory of the sympathetic centres.

It may be very readily understood how extensive adhesions may be broken up in the one case with speedy recovery, whilst in the other but limited adhesions are fraught with peril. In the latter it is far preferable to leave the adherent portions of the sac undisturbed, by cutting them out of the latter with scissors. The term septicæmia is no explanation of the mode of death following ovariectomy, further than the irritation fetid exudations may occasion to the sympathetic ganglionic centres, when it overflows them; for this reason good drainage cannot be lauded too much. These patients all die alike, the unfavor-



able issue being sooner reached in some than in others, from more rapid extension of the vascular paresis in this greatest cavity of the body. Shock following this operation is brain anæmia from vascular engorgement of this territory. It is also of ready appreciation why there is such staining of the inner portion of the thighs, extending over the inguinal and lumbar regions in fatal cases of peritonitis; being due to venous stasis, since the ventricle is paralyzed and no longer aspirates blood from these localities. The lungs do not aspirate blood from the lower extremities, for after abdominal paralysis from destruction of the spinal medulla over the lower portions, blood accumulates in these localities, notwithstanding the unusual energy of the diaphragm it stimulates as physiological compensation for paresis of the lateral walls of the ventricle.

It is also of easy solution why there is a gush of uterine blood at each effort to cough, in cases of hemorrhage from this locality; there is violent systole of the ventricle at this time, with unusual energy over the apex where the womb resides, compressing the dilated organ.

The singular anatomical circumstance of the absence of valves in the venous circulation of the abdominal cavity, so long unaccounted for, receives ready explanation also. No valves are needed inside of a ventricle save at the point of ingress of blood to inhibit reflux during the application of compression force. The femoral and iliac veins have such valves. And the great mystery of the portal circulation has final explanation, as also that of the lymphatic system; especially that portion of it through the devious course of the mesentery, with its rows of glands emptying finally into the receptaculum chyli.

#### THE MANNER OF EXPULSIVE MOVEMENT IN THE VENTRICLE.

This may occur in one of two directions representing the terminal extremities of the trunk, i. e. through the chest region, as in coughing, screaming, barking and vomiting; else through the pelvic excavation, as in defecating, urinating, tenesmus and parturition. Some of these acts are voluntary, others involuntary. Coughing and vomiting are involuntary; so is tenesmus. In the act of coughing the lungs are driven with great force into the upper chest regions, the greatest violence falling upon the apex, from its being driven against the upper ribs. The broad base resting upon the diaphragm distributes concussion force, so that no one portion is unduly strained;

but it is not the case with the conical apex, which receives the whole force of the impetus from below in an impact against the unyielding bony walls which it occasions. This is the reason tubercle elects the upper portion of the lungs in preference to any other. When a scrofulous subject contracts a cough the violence it occasions to the lung apices is followed by cheesy exudation products; it is simply scrofulous inflammation following the injury to the alveolæ. This class of persons should guard themselves against lung concussion, as coughing, singing and screaming with violence. Many a case of phthisis begins from one of these lung exercises. And this is explanation of the clinical circumstance pointed out by Lænnec and Louis of exemption of emphysematous lungs from invasion of tubercle, since it proves the absence of scrofula in them, as the alveolar lesions would have had cheesy inflammation products to follow as a natural consequence of their injury.

The pulmonic explosion is the result of a sudden let-go, or relaxation of the diaphragm after deep descent, and the quick surging of the viscera under atmospheric pressure, against the base of the lungs, assisted by energetic action of the obliques, and especially of the transversales. If the party be thin in flesh the spine itself is tightly embraced by the energy of the contracting force.

Being under voluntary control, the ventricle can be so tightly constricted from below as to empty this portion into the chest excavation, causing the walls to retreat backward upon the spinal region, whilst the hypochondriac sections flare out from visceral impaction. If effort be made to draw down the diaphragm in this condition the flaring becomes still greater, when the ring of cartilage straightens more and more from enormous distention force. Young subjects, having flexible walls, can do this readily enough; but middle-aged persons, especially corpulent ones, cannot succeed entirely. They have more abdominal contents than will fill the excavation; the chest walls besides are more rigid in them.

When explosive energy is directed upon the pelvic organs, the body is bent forward by lumbar flexure till the long axis of the ventricle is made to correspond with the perpendicular axis of the pelvis; when the diaphragm begins its descent, pushing the viscera before it, and those immediately over the basin, (the cluster of intestinal loops suspended by the mesentery with the pendant omental covering.) These movable parts fill the basin to overflowing, when the obliques and tran-

versales transmitting the motor wave from above downward, the diaphragm holding its own, the viscera are packed with great force into the pelvic excavation; compression force being greatest upon the uterus, the bladder and the rectum, since they are at the bottom of the bony vault. These several organs have a complement of muscular force, but need the assistance of the greater force above to expedite expulsion of their contents. The two forces added together in parturition are formidable, and at times even terrific.

#### MUSCULAR MOVEMENT IN THE WALLS OF THE AURICLES.

Muscular substance upon the chest walls is not disposed in such manner as to obtain its full force in chest diastole. The muscular bundles are quite oblique, falling away from the perpendicular axis of the body, having reference more to the uses of the upper extremity than to subserve respiratory purposes. The great serrati and pectorals do not run above a line of thirty degrees, most of the bundles falling below this plane, approaching or corresponding with the transverse axis of the body, thereby losing most all their power of drawing up or elevating the ribs. To effect this they should have inclination in the opposite direction, or toward the longitudinal axis. On the other hand, their point of attachment to operate the chest walls is on a most unstable bone, (scapula,) which rocks with every movement of the arm. Even in walking there is much rocking of this bone, indicated by the motion of the dress. The scapulæ of school girls are as nimble as kittens; and the muscular substance which swings them to the trunk is designed to secure such great mobility for special purposes of the arm and shoulder. The clavicle acts as a flag-staff in swinging the arm out from the body, allowing it to swing free of the trunk; but if accident break the clavicle, the arm falls against the side as a wet rag, useless and helpless. The base of the skull and spinous processes of the cervical vertebræ, suspend this flag-staff by the long ropes of the trapezius and sterno-cleido-mastoideus muscles. This and moving the head is their chief office. They support the shoulder and the arm. What of the serratus and great pectoral? When the arm swings free at the side they are relaxed, and not in a position to perform any movement upon the chest walls to effect inspiration. Moreover, the serrati are obviously enough for quite other purpose, being no less important than that of supporting the entire weight of

the front portion of the body in the quadruped, which swings free of the ground between their broad and powerful muscular bundles. They are made so wide, to cover nearly the whole chest, having insertion into the entire base of the scapula, that they may form the broad swing in which the trunk is rocked as the animal moves along. They enable man to lean upon his hands, or elbows, or to push with force against resisting obstacles. The asthmatic acquires the habit of leaning upon his elbows, as in this position he pushes the scapulæ back, putting the great serrati upon the stretch, and thus making them operative upon the chest wall, which he wishes to help out of the way of lung expansion, since otherwise the lungs would have to lift them up. But this kind of respiration is extremely awkward and abnormal. Moreover, what other mode remains for putting the serrati upon the stretch? What sort of firm fastening do the scapulæ have to effect this? The spinous processes are not strong at best, whilst the thin ribbons of the rhomboidii, and the long fibres of the transverse portions of the trapezius of either side, extending all the distance to the scapular spine, is the weakest and most ineffective mechanical contrivance Nature could adopt to secure that firm support needed for moving the chest wall. Nature is no bungler, and it is a false position to place her in. The muscles of the chest are the analogue to those of the pelvic basin; they have reference to the adjacent extremity, with secondary action upon the trunk itself, moving ALL OF IT, not a portion only. And if firmness of support is measure of traction force to be exerted upon it in respiratory movement, the problem is not of difficult solution where to find the pivotal point. If not in the strong pelvic mechanism, where is it to be found? If the chest walls are to be lifted by the two long muscular ribbons on either side of the neck, it is of ready solution how much work they must do. There is something like three thousand pounds of atmospheric pressure upon the chest to be overcome—not all at once, but a little at a time—that a vacuum of any extent may be formed. Would it not be imprudent to throw a great weight sixteen times a minute upon the cervical vertebræ? Nature does not lose judgment at this point of the circulation. She would not endanger the spinal cord, or the spine itself, in the effort to expand the great heart of animal life.

In all due deference to medical opinion, muscular substance upon the chest walls is for other purpose than chest expansion,



which is of only limited extent and of secondary importance; the chief one being to **SUPPORT THE BODY AND TO OBTAIN SUPPLIES**. The great pectorals are for embracing, climbing, and lifting the body; their extensive points of origin over the front and sides of the chest and ring of the great ventricle, eminently qualifying them for these purposes by strongest possible support; their insertion is into the anterior bicapital ridge of the humerus. With such insertion how can they be effective for lung expansion in ordinary respiration, since they lie loose upon the chest when not specially occupied, by reason of approximation of their points of origin and insertion? In extraordinary respiration, when the elbows are fixed, or the arms are extended above the head, the hands clasping a railing or bed-post, as in the worst forms of diphtheria, some of the muscular bundles inserted into the movable ribs, and not into the immovable ring of the ventricle, or the sternum, may be effective in chest diastole. They are operative in inspiration, receiving much assistance from the small pectorals, whose origin and insertion qualify them to perform regular labor upon respiratory functions. These are potential muscles in respiratory compensation for restricted lung base in the female.

What other muscles remain for consideration in this locality? The subclavius, short intercostals and levatores anguli costarum, near the dorsal articulations, inclusive of the small scaleni with which they have associate function in deep inspiration, as also the little serrati. How much work do they perform? Upon this strong anatomical evidence, and muscular law, we therefore reiterate the statement that lung expansion is not effected through the muscular apparatus of the chest, but that of the abdominal territory. An autophysiological experimentation confirming this statement is that of aborted inspiration spoken of above. The hand removed from the abdomen where muscular energy is most violent, and placed upon the **UPPER** chest region discovers only slight movement in these ribs. The diaphragm moves the others; hence the lower ribs are the more active ones. This would account for the more rapid distention of the lower lobes, and the more gradual filling up of the upper ones after the lower ones are filled, toward the end of inspiration, and **FULL ONLY AT THE END OF THE DEEPEST INSPIRATION**. Hence, in ordinary respiration, the lower lobes are the more active portions, doing the greater part of the work, (nearly all of it.) This is the explanation of



the common occurrence of pneumonia in these portions ; also of the compensatory breathing in the upper lobes in such condition, indicated by deeper and more hurried movement. The physiological experimentation of removing the chest muscles fully confirms it. Respiration moves on as usual. As the lungs fill up, the muscular substance on the chest walls **LIFT THEM OUT OF THE WAY**, so as not to interfere with **LUNG EXPANSION**. To do this requires considerable work, as in addition to their own weight they have to lift that of the upper extremities, being fully as much as they are able to do. If relieved of the weight of the upper extremities, by resting them upon a table, that amount could be expended in active effort to form a vacuum, and thus expedite the filling of the upper portions of the lungs. This is the explanation of the behavior of the asthmatic. He rushes to an open window, and **PROPS HIMSELF UPON HIS ELBOWS**, thus keying up the muscles of the chest by acting upon the scapulæ through the ossa humeri.

#### MUSCULAR MOVEMENT IN THE NECK TO FACILITATE VENOUS FLOW FROM THE INTRA-CRANIAL TERRITORY.

When the circumstance has full appreciation that it is of the utmost importance to expedite escape of venous blood from the cranial excavation, where its detention but for the short space of a minute, or even less time, would lead to fatal consequences, (by reason of the unyielding bony walls inhibiting arterial influx, else from rupture in its system of over-distended capillaries or arterioles,) the study of the mechanism assumes commanding interest and importance.

And the manner of arrangement of this system of blood tubing to effect the object sought, does not flag in degree of interest it excites as the student proceeds in the various steps of the inquiry ; nor suffer by comparison with the wonderful and comprehensive vascular apparatus for the transportation of arterial blood through this matchless domain, the prime object being to dismiss venous blood out of the reservoirs for its collection, chiefly at the base of the brain, as rapidly as it collects in the sinuses, that deoxydized arterial blood may flow into them through this same system of vessels, the arterial capillaries terminating in that of the venous. If the latter have arrest, the former become engorged, and life imperiled with

most alarming rapidity. And if ever it begin again after such final arrest, it will be on condition only of previous vacation of the venous blood, with fresh irrigation of brain substance by arterial overflow, when respiration revives, followed more or less rapidly by cerebation, when all the splendid mechanism is once more in running order. And its movements may have arrest at any time in the same manner—it is a law of the vital mechanism. But resuscitation after such event is of most difficult performance. The nausea which precedes returning consciousness is Nature's effort to overflow the brain substance with fresh arterial blood, by firm compression of the aorta trunk at the crural flood gate, effected through energetic action of the diaphragm.

The increasing number of deaths from cerebral hemorrhage, and inflammation products which the smaller capillary hemorrhage provokes in the brain substance, in public men, (speakers and musicians especially,) is undoubtedly due to venous obstruction in the respiratory apparatus, with the inevitable reflux upon the cerebral circulation it occasions.

Venous flow from the lateral sinuses is specially aided by the wide permanent lumen of the deep jugular origin, and **MODE OF TRANSIT BEHIND** the great muscular ropes of the sterno-cleido-mastoid muscles, which give them safe conduct to the great trunks of the venæ innominatæ, and slight remove only from the central reservoir. The relation which these venous conduits sustain to the muscular ropes which divide the lateral aspect of the neck into their two great triangles, is strikingly illustrated in threatened asphyxiation. In this condition these muscles stand out as great cables stretched between the base of the skull and the middle of the auricles, not to dilate the latter, for their insertion would not promote this movement, but on the contrary to perform a high order of work of a different character; being no other than to lift up atmospheric pressure from the jugular conduits and allow for more rapid descent of the blood from the intra-cranial region. And the force of this pressure may have appreciation by the degree of crushing in of the softer cervical tissues, tightly fitting them around the muscular ropes, and by the great depth of the excavations at the root of the neck, resting upon the very apex of the lung. These ugly depressions are **OUTSIDE THE CLAVICULAR INSERTION** of the cables. The double insertion below is the best possible arrangement for the distribution of this force so as to ward off pressure from

the great underlying canals near their confluence in the vena innominata of either side; whilst their attachment to the mastoid eminence on either side, by placing the broadest portion of the base of the skull between their upper extremities, is sufficient reason why these two great cords should stand out in relief their entire length and widen the neck in front when they tighten under the electric current. The arrangement to drain the venous reservoirs at the base of the brain would appear to be perfect. Forced expiration, as in blowing upon wind instruments, or in carrying high notes, is obstructive to venous descent, as it is arrest of aspiratory force in the auricles, with consequent suspension of the onward movement in the venous column into the pulmonic territory. In this condition of lung collapse from constringing force, the sternocleido-mastoid muscles act with great energy in the effort to lift up atmospheric pressure from the two discharging conduits of the venous reservoirs of the encephalon. If these muscles were really inspiratory, as had been suspected, they are moving out of time when they become rigid in expiration. Moreover, they could not be inspiratory if they would, since they have insertion into the rigid and unyielding portions of the chest walls. They have triple functions, however, viz.; 1st. They move the head from right to left, and vice versa, by alternating contractions, turning it upon its pivot. When they act together, (the trapezii not opposing,) they flex the head upon the breast. 2d. They regulate venous flow through the deep jugulars. 3d. They aid in supporting the arm and shoulder.

Deficient aeration of the blood is urgent necessity for hurrying the circulation, Nature endeavoring to present as many red corpuscles for oxygenation as possible in a given time in the lung organs; hence the action of these neck muscles, to expedite venous descent as well as to relieve the brain.

#### PHYSIOLOGICAL EXPERIMENTATION OF REMOVING THE MUSCULAR ENVELOPE OF THE CHEST WITHOUT EMBARRASSING RESPIRATION.

Case 1. A large male cat was chloroformized, and the scapulæ separated from the spinous attachments and clavicular articulation, and pushed in front, so as to relax and render inoperative all the great muscular bundles of the chest surface. There was no interference with respiration. The small dorsal muscles having insertion into the angle of the ribs were next

divided, with similar result. The intercostals are so delicate in a cat, that for fear of penetrating the pleura they were let alone. The number of respirations before the operation was forty; after the operation they were also forty per minute. Respiration was not affected. The animal was now killed with chloroform, with the view of ascertaining the action of the drug upon the heart. When respiration had ceased altogether, the sternum was lifted up by separation from the cartilages, and the heart exposed. It was beating regularly in perfect rhythmic movement, and continued to do so for six minutes, growing more feeble after the first several minutes. Movement was most prolonged in the auricles.

Case 2. A bull terrier was chloroformized and treated in the same manner with the cat. Respiration was not affected, continuing a regular and gentle to-and-fro movement between the two great cavities. This dog was now trephined, to make experiment upon the brain circulation. Both hemispheres were uncovered. With each inspiration there was brain motion, and when sections were removed by the knife there was profuse flowing of blood, but no spurt or jet shot out of the arteries as in other portions of the body when an artery is divided. The brain is irrigated by gentle overflow.

SELECTIONS FROM PHYSIOLOGICAL EXPERIMENTATIONS SHOWING  
COMPRESSION OF AORTA TRUNK AT THE CRURA OF THE DIA-  
PHRAGM, DURING CONTRACTION OF THIS MUSCLE IN INSPIRA-  
TION, WITH CORRESPONDING ARREST OF THE ARTERIAL FLOW  
THROUGH THE TUBE.

Case 1. A strong male cat was chloroformized, and incision made on the left side from the inferior rib to the crest of the ilium, following the anterior margin of the quadratus lumborum muscle. The incision was several inches in extent, and made upon a grooved director till the peritoneum was reached, when it was laid aside; the index finger was then inserted and the peritoneum carefully pushed off the crura. This having been accomplished, the grooved director was cautiously inserted between the right crus and aorta trunk, so as to isolate the former; and for better protection to the artery its groove was directed upward, and section of crus performed by cutting from the groove outward and upward, the back of the bistoury rest-



ing in the sulcus of the instrument. I subsequently found the crus could be torn loose from its attachment to the lumbar vertebra. When it can be done without expenditure of great force, it is the preferable method, since the nutrient artery which supplies it causes some hemorrhage when first divided, though it always ceases of itself. After section, chloroform was discontinued. After more than ordinary delay, there were some symptoms of returning animation, but the pupils remained large, with great amount of torpor. It was presently observable that the animal was blind, and behaved in a singular manner, seeming to lack sense or intelligence. It was placed in an open barrel and carefully watched. There was constant tremulous motion of the head, simulating paralysis agitans very remarkably. Whilst this was going on the animal seemed to be making effort to inspect its surroundings, moving its nose over the bottom of the barrel from side to side, as if in search of something, but not attempting to rise up, acting like an immature kitten freshly come into the world. There was complete anæsthesia, as no amount of tail bending or pinching attracted the least attention. When passing its nose over pieces of meat (which were now placed in front of it) it would stop for a moment, then resume its movements; after a time it made efforts to eat it, trembling violently all the while. The lower portions of the body were perfectly still. In an hour it could see some, but was not able to sit or stand up. It took some milk from a saucer. In an hour and thirty minutes it sat up, and began to pay some attention to its wound, but continued stupid to a degree. The tremulousness grew less, disappearing in two hours. Three hours subsequently it was sitting up, but dull and listless. It was placed in a large room and carefully attended. Intelligence improved with the returning activities. In four days the animal was killed intentionally with chloroform. The heart continued its pulsations five and a half minutes after the chest had been fully opened. Post mortem:—There was great contraction of aorta trunk below the superior mesenteric artery, extending beyond the renal artery. This portion was not more than half its natural size, round, hard, and of pipe-stem appearance; whereas the upper and lower portions of the tube were as large again and flattened out. This was the manner then that cerebral hydraulics had compensation made for the loss of hæmic control higher up the tube. And as a result of this procedure, there was anæmia of the pelvic viscera, with diminution of the renal activity, at-



tested by greatly diminished excretion, and a bleaching of the lower viscera at the post mortem, as also of the kidneys. As the animal kept very quiet, moving about but little, there was not great necessity for large amount of blood in the lower extremities. Moreover, during such exercise the blood has most forcible direction upon the brain and spinal cord, where it is needed to generate muscular force, accumulating here and in the trunk, especially in the chest cavity.

To exclude the factor of shock, which would probably have introduction to vitiate the force of the physiological bearing of the operation, another cat of equal size was chloroformized, and same extent of incision made at the same locality, (excepting division of the crus.) Cold water was poured into the wound to intensify shock; in nine minutes the wounded cat got up and moved away.

Case 2. A young dog, nearly grown and very active, being chosen on this account, was chloroformized and the crus divided as in the cat. When the grooved director had been inserted it compressed the aorta so tightly as to arrest the arterial current, and in consequence suddenly aroused the cerebral activities, by the great arterial flow it determined over the brain substance, the animal making vigorous efforts to get away, and barking vociferously. At last, by dexterous movement, the knife was placed in the desired position and the crus divided. Immediately this was done all demonstration ceased, all movement stopped abruptly, and there was substituted a new and completely opposite order of vital phenomena for those that had arrested previous attention, viz: collapse, stupor and anaesthesia. In an hour and a half the animal stood up, trembling with excessive weakness. It is remarkable, but a dog will make extraordinary effort to get upon his feet, and will stand as long as he possibly can. After three hours he showed some restlessness, moving about, but exhibiting great weakness, staggering, his hinder parts rocking from side to side. He was listless and torpid, though there was appreciable return of intelligence as the interval since the operation increased. He would stand as long as he could, then sit down, then lay down. The rocking of the hinder parts always taking place before the sitting down; he had to sit down from sheer debility, and assume a horizontal position from the same cause. After resting awhile he would get up and move about as before, till the same symptoms recurred. He had lost control of his arterial circulation by reason of the ruined flood-gate, with

consequent brain anæmia which it occasioned. But in nine hours after this event he could move into a fast walk, and could even trot, urged by a rope around his neck, the party running in front. He showed no sign of suffering from anything but languor and weakness, explained by the cerebral anæmia. The next day he was more improved, exhibiting considerable amount of intelligence, which was conclusive proof of arterial condensation somewhere in the great aorta trunk, compensating for the section of the crus. He relished his food, and moved about with freedom and evident pleasure. At the time of the operation, in order to eliminate the circumstance of shock (which the profession believe in with such immeasurable faith, mistaking it as an entity, or something inherent in nervous action, when it is an alteration in the hæmic hydraulics only, involving diminished supply of arterial blood to the great cerebro spinal axis,) another dog was placed under chloroform and the parts divided to the same extent, excepting the crus. The dog was quite fat, and some of the viscera escaped through the rotten peritoneum, which had been injured by fatty metamorphosis. They were carefully replaced and the parts closed with interrupted suture. In fifteen minutes the animal sprang off the box he was lying on, which had served the purpose of operating table, and had to be caught by the rope around his neck, and fastened, to prevent his running away. The effects of chloroform quickly pass off.

Respiration is not affected by division of the crus; moreover, that circumstance would not explain the symptoms.

Nothing had happened the first dog differing from the other, save section of the tendon, with sudden loss of support to the cerebral blood column it occasions. Forty-eight hours after operation the wound in his side was still open; the skin flaps that had been twisted together with wire suture were loose and nearly free of secretion, there being no such exudation of plastic lymph, as occurs in the normal condition, to connect the lips of the wound and repair the injury, else by the granulating process. The inference drawn from this latter circumstance was great arterial condensation of aorta trunk in the vicinity, cutting off or greatly reducing the blood supply to the lumbar arteries given off from it, on the supposition arterial condensation had taken place at the point of election in the cat.

Would his misfortune stop here? He had made great compensation for loss of arterial support at the ruined flood-gate;

but what was it to cost him? The activities originating in the cephalic mass could be abated in degree and frequency; but what of those residing in the sympathetic system below the point of constriction? How compensate for deficient renal secretion; for anæmia of the pelvic viscera; for anæmia of the lower extremities?

Atrophy of his testicles, from deficient supply through the spermatic arteries, would hurt his powers of procreation only. I have him under observation.

Case 3. A strong cur was chloroformized, and section of the right crus performed. Whilst the grooved director was in place he struggled to get up; but when division was effected he lapsed at once into deep coma, so that no amount of pinching or tail bending had the slightest effect upon him. There was great dilatation of the pupils. He paid not the slightest attention to the closing of his wound by sutures. In eighty minutes he succeeded in getting upon his feet, rocking a great deal in the hinder parts. He remained drunk till night, when no more observations were made. In the morning he was quite intelligent. In seven days the wound had not closed, nor the nutritive processes much advanced. The animal was killed and the wounded parts carefully inspected. There was great contraction of aorta trunk, extending above and below the passage of the crura, the condensation being uniform and continuous for nearly two inches in extent.

I have preserved a number of these arterial specimens, which sustain striking resemblance, the point of election, however, not always being the same portion of the tube, sometimes extending higher up the thoracic aorta, in others reaching lower down the abdominal trunk.

PHYSIOLOGICAL EXPERIMENTATIONS SHOWING THE CARDIAC FUNCTION OF THE ABDOMINAL WALLS TO ASPIRATE AND TO EXPEL BLOOD OUT OF ITS VASCULAR APPARATUS, AND THE ESSENTIAL NATURE OF THIS FUNCTION TO THE CONTINUANCE OF LIFE.

Venous blood is lifted from the lower portions of the trunk into the pulmonic reservoirs for oxygenation, through the agency of two great levers, viz: MUSCULAR FORCE in formation of vacuum areas, and co-operation of ATMOSPHERIC PRESSURE FORCE. The veins contribute something to the first of these two factors, but the major portion of

the work is performed by the great muscular envelope of the trunk, more especially through the walls of the ventricle. The following vivisections were made with the object of discovering the relative amount of labor performed on the venous circulation by the respective portions of the trunk; i. e. whether by the auricles or the great ventricle.

Case 1. A full-grown female cat was chloroformized, and the phrenic nerve of each side divided, in order to paralyze the diaphragm, the arch of the ventricle and most active portion of its walls. There was great embarrassment to respiration upon section of one of these nerves, but after division of the remaining one death took place almost immediately. Post mortem examination: Much venous discoloration of abdominal contents from great engorgement of the portal system, which was universal. The vena cava trunk and tributaries full of blood. Lungs normal; right heart full; left one empty. The descending cava and its depurating veins full of blood. The interpretation of these phenomena is simple enough. The big end of the ventricle having been paralyzed through section of the phrenics, the power to expel blood out of its vascular apparatus was no longer present; hence its accumulation in such great quantity in so short a space of time. The absence of lung engorgement was due to the arrest of so much blood in the ventricle below, together with inability of the right heart to transfer the blood accumulating in its reservoirs from the upper portions of the trunk into the pulmonary capillary system, which in consequence remained empty, the auricles not being able to form a vacuum without assistance from the diaphragm.

And death was due to basilar anæmia from NON-ARRIVAL OF FRESHLY OXYGENATED RED CORPUSCLES in the great nervous centres, the integrity of the phrenic nerves being essential to the cardiac force in the ventricle, and the aspiratory force in the auricles, for the due circulation and oxygenation of the venous blood. Hence they are the most important nerve lines to the muscular envelope of the respiratory mechanism. Section of the pneumogastrics interferes with aspiratory force in the auricles by causing extensive paresis in its vascular apparatus and air tubing, with consequent delay in the onward movement of the blood, and expulsion of air; these nerves being the motor and sensory trunks to its non-striated muscular substance and mucous membrane. And if it were not for the additional aid contributed through



the posterior pulmonic plexus from the upper dorsal medulla, life could not continue long after their section; as it is, much cough and dyspnœa follows it, with supervention of pneumonic inflammation, the animal finally dying of combined starvation with deficient aeration of the blood; not being able to swallow from the œsophagean paresis it occasions.

Beyond a reasonable doubt, asthma is result of a neurosis of the pneumogastrics; in extreme cases probably involving the dorsal plexus of the lungs.

Case 2. A dog, twenty-two pounds weight, (an English terrier,) was chloroformed, and a grooved director inserted under the integument at the front edge of the quadratus lumborum of one side, carefully divided upon a line with the umbilicus to a corresponding point upon the opposite side. The flaps were then carefully dissected up from the muscular substratum, so as to fully expose all this portion of the muscular envelope, the object being to leave no muscular power in the anterior portion of the ventricle. This was now carefully divided and liberated from the peritoneum by incisions crossing the fibres of the obliques and transversalis of either side. The rectus abdominis of either side was treated in the same manner, till finally muscular power in the anterior half of the great ventricle was abolished. The skin flaps were now replaced and secured by running suture. The amount of blood lost was exceedingly small; I do not think it exceeded one-half ounce.

In the course of some fifteen or twenty minutes, when the chloroform narcosis had passed off, the animal made unsuccessful efforts to get up and move away; but when it did succeed at last, staggered from side to side till it fell over upon the ground. To prevent this it would spread its legs and prop itself, changing the position frequently. It acted as though under cerebral concussion; finally, it made a lunge for a pile of plank standing near, stacked upon pieces of wood, creeping nervously under it, its hinder parts rocking from side to side. It made the feeblest bark, and repeated it several times. It could not well have been lower, to have been heard twenty feet away. The animal did not appear to suffer, as it uttered no sound of distress, nor made attempt to examine its wound.

Medicine would say the animal was under shock, as if there is such thing, irrespective of sudden withdrawal of blood supply to the cerebral cortex. In this instance it was attributable to non-arrival of the due amount of cerebral blood, for the generation of the cerebral processes, concerned in muscular



action and cerebation, or generation of thought. And chargeable to the loss of compression force over the cava ascendens and vena porta system of vessels.

The animal lived twenty-three hours, dying of cerebral anæmia. It warded off the fatal issue as long as possible, by **STANDING** in a corner of its kennel, **WITH ITS HEAD ALMOST TOUCHING THE GROUND**, till within several hours of its death; this position being most favorable for keeping the cerebral circulation full. It made **NO** complaint, the cerebral anæmia being sufficient to repress the generation of pain, its entire time being occupied upon the hæmic hydraulics, and life's sustentation it involves.

Post mortem two hours after death: No rigor mortis. Intense congestion of abdominal viscera, with great fulness of vena cava ascendens and tributaries. Considerable lymph and peritoneal juice: congestion of inguinal regions and fulness of crural veins immediately adjacent; kidneys and spleen congested, and the liver of mahogany color; its venous stasis being so great. The gall bladder distended from loss of compression force. The pelvic viscera much discolored from venous stasis. Some fluid in the urinary bladder. The parietal peritoneum appear to be normal; viscera of chest cavity normal; the right heart full, the left one empty. There is a blanched appearance of the sub-cutaneous chest surface, of neck surface, of face surface, of peri-cranial surface, and of the cerebral surface and substance. Death was due to basilar anæmia, from excessive blood diversion to the vascular apparatus of the abdomen. In other more explicit statement, death was result of the non-expulsion of the blood out of the great ventricle in the heart of animal life, with the failure of the cerebral circulation which it involves. The result of the post mortem placed beyond question the mode of death, fixing it in the alterations effected upon hæmic hydraulics in the abdominal vascular apparatus, due to destruction of aspiratory and constringing force in its muscular walls, with resulting absence of power to lift the venous column into the pulmonary apparatus on its way to the left central reservoir for brain supply and general distribution. It therefore continued to accumulate in the lower trunk, at the expense of the upper portions. till this great section became nearly exsanguine, and a longer continuance of life impossible, from extreme cerebral anæmia.

Case 3. A large female cat was chloroformized, and the abdominal walls divided by crucial incision, extending from the

ensiform cartilage to the pubes, and from one quadratus to the other, upon a line with the umbilicus, care being taken not to penetrate the peritoneum, by cautious insertion of the grooved director under the muscular bundles before division. The edges of the skin flaps were then carefully readjusted, and securely fastened by running suture. A cord was passed through the deep tissues over the sternum and those over the pubis, and the ends pulled through so as to draw upon the upper and lower fastening, and when the front of the great ring (which had suffered elevation and removal) had been pulled down to its proper position, the free ends were securely tied in the middle and the patient laid carefully away. She died in the night, and was cold and stiff in the morning, living perhaps for twelve to fifteen hours after the operation.

Post mortem examination: Extreme engorgement of the entire viscera of the abdomen; the cava trunk and portal system full of blood; liver of mahogany color; gall bladder full; much injection of the stomach and intestines; spleen engorged; kidneys not so much congested; urinary bladder empty; some congestion at root of left lung; right heart partially filled; left one empty; a blanched and exsanguine condition of the upper portions of the trunk; the skin surface and fasciæ of the chest, neck and pericranium white and colorless; brain substance very white, and but little blood in the sinuses.

Cause of death—**BRAIN ANÆMIA** from blood diversion to the lower portions of the trunk; such diversion having been due to loss of muscular force in the great ventricle to lift it up the cava into the central reservoir for aeration and general distribution.

Case 4. A female cat, two years old, was chloroformed, and the spinal medulla below the fifth dorsal vertebra destroyed by cutting through the arches of several dorsal lamellæ, and running a wire from above downward, so as to destroy the cord. Recovery from chloroform speedy; complete paralysis in lower trunk. Three hours after the injury the animal stood upon its fore feet and regarded me when I went to inspect her. The hinder parts were stretched out upon the ground. The eye had a wild look, but she did not seem to suffer. There was no crying of distress, and the wild look I attributed to commencing brain anæmia. It was a dry eye from want of the requisite amount of blood, and abeyance of secretory function in consequence. Respiration not embarrassed. Duration of life twenty-four hours.

Post mortem examination : There is no red staining of the anterior peritoneal surface, as in the third case ; but the congestion of the abdominal viscera, from portal and vena cava obstruction, exceeds anything I have ever witnessed. All the viscera ~~was~~ intensely congested ; the liver has a dark mahogany appearance, and the terminal trunks that converge into the portal veins seem twice their natural size. The kidney congestion is extreme ; the gall bladder full to bursting ; the urinary bladder empty ; the crural, iliac, and common cava trunk full of blood ; some staining of the inguinal regions. In the chest cavity there is some pulmonary congestion, explained by injury of the pulmonary dorsal plexus of nerves given off at the fifth dorsal vertebra. The heart moderately full of blood on the right side ; empty on the left ; blanching of the tissues of the chest surface, of the neck surface, and of the face surface. Upon opening of the cranium no blood escaped, so great had been the brain anaemia. Its surface is firm and blanched ; no blood in basilar plexus. Death by basilar anaemia, from blood diversion below the diaphragm, chiefly in the abdominal cavity.

The result of this experiment afforded incontrovertible proof that the abdominal walls have cardiac power to propel blood, and serve the purpose of a ventricle to lift venous blood into the chest cavity, otherwise it would not accumulate in the excavation after paresis. The operation had this effect upon its muscular walls, and no force being present to drive out the blood it continued to accumulate, till sufficient depletion had taken place in the brain to suspend respiration. Atmospheric pressure force had been of great effect, but not sufficient to prevent accumulation, from loss of ventricular force. In order to eliminate the factor of vascular paresis being the cause of the blood diversion, I resolved upon another operation, which would remove that factor, giving the net result of paralysis of muscular energy only in the walls. I resolved upon incision through the walls, so as to render contraction abortive in the systole, by emptying out the viscera, which takes off pressure from the portal system and cava trunk.

Case 5. A large strong male cat, several years old, was chloroformized, and incision made through the front walls of the ventricle from near the ensiform cartilage to the pubes. The contained viscera were encouraged to present through the opening, but owing to the shortness of the suspensory ligaments met with only partial success. It was impossible in this

manner to completely empty the ventricle and prevent all pressure upon the vena porta and cava. Nevertheless, the animal remained in a stupor the whole time the viscera protruded, the cerebral circulation being insufficient for the generation of the mental processes. When the animal was pinched or disturbed it would make momentary effort to defend itself against the attack; but immediately its head would again fall to the earth and its eyes close in deep sleep. An hour was so occupied, when the viscera were replaced into the ventricle and the opening closed by interrupted suture. Five minutes afterward the animal revived, sat up, licked its paws, and examined its wound. After the expiration of some minutes, when animation was complete, the interrupted sutures were quickly divided and the viscera again allowed to protrude. Torpor and mild coma ensued at once.

Case 6. A large dog, of mixed breed, was chloroformized, and incision made through the linea alba, several inches in extent. At inspiration some of the omentum protruded, the largest quantity escaping during the deepest inspirations. This was undoubted proof of a diminished abdominal area during inspiration; and reduction of area is in proportion to the energy of the inspiratory movement, being greatest at the height of deepest inspiration. This circumstance has many corroborative facts in medical experience; as hernial protrusions leaping outward during coughing and vomiting, or straining at stool. The incision was now enlarged to allow of the introduction of the hand, to make further exploration of the alterations that ensue in the abdominal walls during inspiration. The diaphragm initiates the movement, but after it has descended a little way from its high elevation, there is a counter movement in the lateral walls of the abdomen, growing in energy rapidly in the later stages of diaphragmatic descent. The lateral walls and diaphragm are in accord beyond a doubt, acting synchronously, and in this manner bring about reduction in the abdominal area, and cause visceral escape during inspiration. An incision was now made transversely through the walls from one quadratus to the other, upon a line with the umbilicus. The diaphragm immediately commenced contracting with the greatest energy, to compensate for the loss of muscular force below, felt at once upon the great nervous centres. The energy of the diaphragm was very striking. The animal survived over an hour, when respiration had suspension from basilar anæmia. The central organ was now exposed, and found to be



pulsating as usual. After nine and a half minutes some motion was still perceptible in the auricles, having but just disappeared from the ventricles.

Such frequent reference has been made to the **PERSISTENCE OF CARDIAC MOVEMENT** in all forms of death, that no occasion exists for further reference to it here, except perhaps to indicate the most effective mode of suspending its action, which is done by suffocating the animal, and is purely **MECHANICAL** in its mode of operation, the organ suffering such extreme degree of distention from amount of blood it contains as absolutely to inhibit systolic action. The right cavities are full almost to bursting, as are also the jugulars and cerebral reservoirs. This mode of arrest of the vital mechanisms is consequently the most difficult to recover from, or to effect resuscitation movement in; and we are of opinion that it would be good practice to relieve the distention of the right heart, by means of a trocar and canula inserted into the ventricle, the point of election being between the third and fourth costal cartilages on the right side, keeping close to the sternum, the point of the instrument having direction toward the mesial line. Blood drawn off in this manner would relieve not only the enormously distended organ, but also have most benign effect upon the vascular apparatus of the respiratory centre. The heart is very tolerant of such manipulation, a circumstance I have most fully proven by repeated experiment. I have had an animal to revive with an awl transfixing the ventricles, after respiratory movement had ceased for some minutes, from the toxic effects of chloroform. It was revived by suspending it by the hind legs and making rhythmical compression around the chest wall (the left chest was open.) It made vigorous effort to get away, when I destroyed it instantly by cutting the ascending aorta from the heart.

I have over and over again (after suspension of respiration by chloroform) exposed the heart from the left side, and made a puncture through the right ventricle, (the uppermost one,) the blood escaping through the wound into the pericardial sac, (in one instance almost filling it,) and have witnessed its arrest by formation of a clot occluding the cardiac wound, and had the animal to revive after suspension, and rhythmic compression of the right chest. We therefore have no hesitation in uttering the opinion that the heart is very tolerant of injury. A broad blade may sever important ganglionic connexions in its substance, hence should not be used; a trocar would not do



this. The explanation of cases of death following small cardiac wounds is not from primary suspension of cardiac movement, but to be ascribed to DIMINISHED energy in the organ, withholding the normal amount from the encephalic territory. And if the chest be opened, the organ would be found to continue its movements for minutes later. It is the case when destroyed by a blow from an axe upon the head, or after being shot through the head, or after amputation of the head itself. It is the same after death from toxic agents. The persistence of cardiac movement over all other vital phenomena is a law of the animal mechanism. In case of sudden death from a stab wound, the body should have inversion, and rhythmical compression made around the chest.

In respect of the difference of the cerebral circulation from other portions of the body, ascribed to unique modifications in its vascular apparatus, the experiment of dividing an arterial trunk in one of the extremities, at the same time slicing off the brain substance till the terminal trunks of the internal carotids be opened, (having previously exposed it with the trephine,) will leave not longer room for doubt; for the instant the former artery suffers partial division, a jet of blood shoots out of the wound to the distance of some feet beyond the body; whereas, when made into the internal carotids, blood rushes over the contents till it overflows the cavity, and runs down the outside walls, but never jets or spurts out upon the floor, as in the former case.

Muscular energy is the force of the circulation, and since the MEDULLA BULB IS THE CENTRE OF MUSCULAR FORCE, it follows as a corollary it is the centre of ARTERIAL FORCE; and such really is the case, for if the posterior lobes of the great hemispheres be carefully removed, and the index finger be gently pressed upon the ant surface of the pons so as only to stimulate the nerve substance, the heart will be hurried into tumultuous action. The finger may be passed down to this region without removal of much brain substance. The chest should be laid open so as to expose the heart and have it under observation during experiment. The par vagum like other spinal nerves is motor and sensory, a small spinal cord, administering to the vascular apparatus of the chest and abdominal viscera, and distributed to its NON-STRIPED muscular substance and MUCOUS MEMBRANE. After section of these nerves there is paralysis of œsophagus, stomach, and upper portion of intestinal tube; as also over consid-

erable portions of the pulmonary apparatus, making respiratory movement difficult, from inability to express the blood and air; and but for the pulmonic plexus of nerves given off at the fourth and fifth dorsal vertebræ, the animal would die speedily from asphyxia. Loss of nervous force to the heart has degree of compensation made through the three pairs of cervical ganglia. The œsophagus receives some assistance from the pulmonic plexus, and spinal influence upon the viscera of the abdomen increases from this point down. The great solar plexus receives the three pairs of splanchnic nerves, as also some power through the phrenics. For this reason, section of the great pneumogastric wires is not followed by absolute paresis of the chest organs and upper abdominal viscera, yet is sufficient to occasion severe cough and pneumonia within a few hours, with progressive increase till the animal perish, or is killed out of feeling of commiseration. If life be not terminated by pneumonia it would do so by starvation, the animal being no longer able to swallow, or even to retain what food he may have in his stomach, since the systole of the great ventricle causes it to REGURGITATE; and coming up into the pharynx, in the way of ingress of air through the rima glottidis, some of it is swept down the trachea under atmospheric pressure, to add to the pulmonic trouble.

But all this matter has full consideration in the chapter on the circulation of the blood, and functions of the cerebro-spinal axis, whose nerves indicate special vascular territory which they regulate on occasion.

In a suckling bitch the mammary arteries are twice the size they are in the interim, owing to special ganglionic influence.

Let the circumstance be ever borne in mind that whilst the spinal medulla is the reflex centre to STRIATED muscular fibres of voluntary muscles of the trunk and extremities, that it is also the reflex centre to NON-STRIATED muscular substance of THE VISCERAL TERRITORY, with extension to the vascular apparatus of the extremities, that both striated and non-striated muscular substance have nerve-arcs passing through it and focused in the lateral tracts; the latter terminating in the double row of dorsal ganglia, which they energize. Knowledge of this latter circumstance is essential to full appreciation of the most important part of vital performance, since HÆMAL HYDRAULICS HAS REGULATION BY THESE NERVE-ARCS.

## CHAPTER IV.

### RESUSCITATION.

The movement of resuscitation is the same as that for evolution, extending from the heart to spinal medulla and medulla bulb, thence to the cerebral cortex. **THE INTELLECT IS LATEST TO REVIVE**; the first to yield; the last constructed. Such is vital order.

To hasten the movement **INVERT THE BODY** and make hot applications to the head; at the same time make use of rhythmical compression of the chest with electric currents along the spinal medulla and abdominal territory, to provoke muscular movement of the great cardiac pulsation, or **RESPIRATION**.

### DEATH.

Interrogatory: What is death? To make concise statement it is reversal of evolution. The manner it may be effected from disturbance in the individual mechanisms is matter of detail only, as death is always the same process. The mode of constructing the stellar constellation in Life's Form has had consideration in the preceding pages, and what remains is solution of the manner of its breaking up.

The cohesive power of animal organisms is maintained through the functions of the cerebro-spinal axis, containing special centres of force; the most important being in the medulla oblongata, or respiratory centre. Somatic death results from suspension of the circulation of oxygenated red corpuscles over the nerve ganglia of this most important territory. Life's pivotal point is in the integrity of the basilar circulation, and anything which may disturb it is inimical to life. The basilar artery is in consequence the most important hæmal conduit, as it is the deepest laid and best protected arterial canal in the entire domain. In the chapter on the circulation of the blood this matter has full consideration, but for present inquiry anatomical detail is not necessary. The muscular substance of the basilar artery is under control of ganglionic centres, but not to the same extent as the carotids and other portions of the arterial tubing; more especially what administers

to SECRETORY function. Being under control of nerve ganglia, it is necessarily subject to whatever influence is operative upon the ganglia; hence DEATH from NERVINES, and traumatic injury from a blow or other violence. Chloroform in excessive doses interferes with the LUMEN OF THE BASILAR ARTERY by over-stimulation of its muscular substance, and reducing in proportion the number of red corpuscles which should pass over the nerve cells of the respiratory centre, in order to sustain uniformity in respiratory movement. It should be borne in mind, however, that this centre is not all the nerve force of respiration supplied by the VERTEBRALS, since the reflex centres in the cervical medulla, notably the respiratory nerves of Sir Charles Bell, (phrenic and long external thoracic,) are similarly furnished. The vertebral arteries supply the CERVICULAR MEDULLA as well as the MEDULLA BULB. This most important nerve territory in the body has, in consequence of the dignity of its function, received corresponding attention from Nature, in wonderful provision against accident to itself or to the arterial tubing which supply it. An overdose of morphia interferes with this circulation, but before doing so it will have condensed the arterial apparatus in the two hemispheres, producing deep coma as a consequence; for coma precedes suspension of the respiratory centre. If the vertebrals were as sensitive to irritants as the carotids, nervines would have to be abandoned. Shock means sudden interference with the arterial circulation of the great nervous centres, acting in similar manner with chloroform or morphia, even to measure of intensity or degree of duration; and marked in the slight cases only by nervousness from diminution of the normal amount of the red corpuscles; and in still greater degree with the occurrence of stupor, and a blanched skin, with irregular respiration; if worse still, by suspension of consciousness and of respiration. All this may be brought about so rapidly, as from a fall or blow, that the succession of symptoms escape notice; but the manner life is restored explains the whole matter of suspension, since respiration revives first; then the intellect returns in degree as measure OF THE RETURNING CIRCULATION OVER THE CEREBRAL CORTEX, being complete only when it is finished. To hurry this movement nausea supervenes, which has the effect of compressing the aorta at the crural flood-gate, through the spasm it excites in the diaphragm, causing the arterial blood to overflow the territory which had been suddenly



robbed of blood. Nausea is Nature's method of quickly correcting the altered hæmic hydraulics of the brain substance; it soon banishes **INSENSIBILITY** from simple brain anæmia. If it result from intra-cranial pressure from cerebral hemorrhage, or inflammatory product, it is next to impossible to provoke nausea, nor would it be productive of good if it could be done. It follows that the essential factor to vital manifestations, whether respiratory or intellectual, is the circulation of red corpuscles over the nervous centres. **THOUGHT** suffers diminution in old age by reason of impairment of the arterial capillaries, with corresponding atrophic change which it implies in the appellate nerve territory. Imbecility has interpretation in large amount of arterial degeneration over the cerebral cortex; hence it is incurable. The circumstance should be ever borne in mind of the relation of the red corpuscles to vital manifestations; the latter being entirely dependent upon their presence in the great nervous centres, and subject to modification by the varying numbers of the corpuscles which may be present at one time; being greatest when they are in excess, and vice versa. **IRREGULARITY** of behavior means **IRREGULARITY OF THE CEREBRAL CIRCULATION**, if the matter have reference to the intellect; otherwise to irregularity of the circulation in the **APPELLATE NERVOUS CENTRE**, or centres of the part disordered.

Any circumstance which interferes with the regular supply of blood to the spinal medulla in the upper cervical region, is inimical to life; so that should one of the vertebrals be divided, death is imminent; if both suffer division, speedy death would result. The wonderful anastomosis of the vertebrals with each other, with additional provision in that of the posterior cerebrals, is explanation of the continuance of life after injury to **ONE** of them. The circle of Willis is an arterial chain connecting the basilar region of the brain with the spinal medulla, marking a high order of mechanical contrivance for the perpetuity of life. The cerebro-spinal axis is encased in a vascular sheath, constructed out of arterial mains, whose minute subdivision it represents, reaching the important province through **FIRM BONY CANALS**, Nature's provision against sudden overflow and inundation.

The vascular apparatus is under control of sympathetic ganglionic centres, with motor and sensory roots connecting with the cerebro-spinal axis, and receives impression from that great trunk line according to the intensity of the electric wave



passing over it. At sight of blood a woman with excitable arteries will faint. Before this result, which is product of cerebral commotion, there is sudden condensation of the arterial tubing supplying the cerebral convolutions, with consequent suspension of CEREBRATION. The very rapid manner this may be brought about is owing to the rich nerve connexions existing between the VISUAL ORGANS and CAROTID PLEXUSES, and their slight remove only from each other. The eyes would appear to regulate these hæmic flood-gates. Death is result of complete suspension of the circulation in the BASILAR TERRITORY, and resolvable into two factors only, viz: 1st, Either from MUSCULAR RIGIDITY in the VÉRTEBRALS, superinduced by TRAUMATIC violence, or by NERVE IRRITANTS, as chloroform, etc. 2d. By ACTUAL DIMINUTION OF THE VOLUME OF THE BLOOD FLOWING INTO THE PART, TILL FINALLY IT FALL BELOW THE AMOUNT NECESSARY TO SUSTAIN LIFE. This may be effected suddenly, as through great hemorrhage; or more slowly, as through starvation, cutting off the source of supply: or by inflammatory process of great extent, as in extensive peritonitis, with amount of blood diversion from the systemic circulation as to almost empty it, rendering the pulse at the wrist imperceptible, and longer continuance of life impossible. Acute fermentative processes, which disorganize the blood, are put upon a footing with high blood temperature, which disorganizes the nervous centres. Infection complicates vital performance by introducing a foreign element into it, but cannot destroy the validity of the vital law. Death remains ever the same vital performance. In other words, there is—1st, Brain anæmia; 2d, Basilar anæmia; 3d, Suspension of the heart's action.

The following are some of the vital problems that have solution in the preceding papers that had remained unanswered, and were unanswerable, upon the basis of present medicine:

1st. Why is man the only animal with a sacral promontory?

2d. Why is the PELVIS so DEEP, if the SHAPE of the excavation be for the purpose of parturition?

3d. Why does the plane of the linea-ilio pectineal line, or top of the true pelvic basin, join the dorsal column AT AN OBTUSE ANGLE, so as to form an INCLINE PLANE? (The case in all high animals.)

4th. Why are the veins of the abdominal cavity without valves?

5th. How is the portal circulation performed ?

6th. How is the lymphatic circulation to be accounted for ?

7th. What is the function of the pneumogastric nerve, including its entire trunk ?

8th. Why is the operation for ovariectomy followed by high mortality ? (Septicæmia is not the answer.)

9th. Why is extensive peritonitis so fatal ? (These are distinct questions.)

10th. Why does tubercle elect the APEX AND UPPER PORTIONS OF THE LUNGS in preference to the lower lobes ?

11th. Why should extensive emphysema pulmonum be indicative of the exemption of the patient from tuberculosis ?

12th. Why does this lesion invade the UPPER PORTIONS of the lungs, the apex especially ?

13th. Why should blowing upon wind instruments affect THE LEFT SIDE OF THE HEART ?

14th. Why should VOCAL MUSIC be frequent cause of PAIN IN THE UPPER CHEST REGION, (sometimes attended with a feeling as if something had given way, and starting point of phthisis in the case ?)

15th. Why should cardiac pulsation INCREASE WITH AUGMENTED RESPIRATION ?

16th. Why should traumatic injury, more especially scalds BE FOLLOWED BY HIGH BLOOD TEMPERATURE ?

17th. In the absence of a fermentative principle in the blood, how is fever to be explained ?

18th. How does the circumstance of cupping, blistering, embrocations, and all forms of counter-irritation, explain THE RELIEF OF DEEP-SEATED CONGESTION, or of visceral inflammation ?

19th. Why should a cold hand, GENTLY APPLIED to the abdominal surface, be followed by increase of contractile energy in the parturient womb ?

20th. Why does bathing in cold water cause urination ?

21st. Why should it excite defecation ?

22d. How does the application of ice check the inflammatory process ?

23d. What is THE ESSENTIAL LESION OF INFLAMMATION ?

24th. How is the action of nervines to be explained ?

25th. What is the explanation of SHOCK ?

26th. What is the interpretation of NAUSEA ?

27th. What is THE ESSENTIAL NATURE OF HYS TERIA ?

28th. What is the explanation of the continuance of the circulation in enormous thoracic aneurism, with ATROPHY of the muscular substance of the heart ?

29th. What the explanation of the action of a hot bath in infantile colic ?

30th. WHY SHOULD IT RELIEVE CONVULSION ?

31st. What are the ESSENTIAL FACTORS to the circulation of the blood and animal juices ?

The several interrogatories relative to the pelvic viscera are designed to bring out more conspicuously the special function of the sympathetic nerves, viz: TO ADMINISTER TO NON-STRIATED MUSCULAR SUBSTANCE distributed over the internal mechanisms; for whilst reflex action upon the womb, bladder, and rectum, from external application, is a familiar circumstance, yet the INTERPRETATION of the phenomena is quite different, since the deduction of THE SOURCE of the great and SUDDEN ENERGY is made not upon the several small sacral nerves to the parts from the sacral plexus, but TO THE DOUBLE ROW OF LARGE LUMBAR AND SACRAL GANGLIA connecting with the cord at EVERY LUMBAR AND SACRAL FORAMEN BY TWO ROOTS, and focused in the enormous HYPOGASTRIC PLEXUS, with its numerous loops, which ENVELOPE EVERY PELVIC ORGAN IN A WEB OF NERVE WIRE. Their sudden shrinkage, inclusive of the arterial trunks of the terminal aorta and iliacs which feed them, is of ready explanation, as ALL THIS APPARATUS is under one system of government. If the stimulus be wide-spread, as a hot or cold bath, or electric current over the abdomen, there is corresponding visceral condensation, with determination of blood to the surface of the body, with sweating as result of the deep arterial tension, a transudation of serum through the capillary walls of the sweat glands, made under pressure. After sea bathing, stimulants are had recourse to, to overcome the sudden DEBILITY, and WEAKNESS, and GIDDINESS, from the brain anæmia; which ALCOHOL removes BY RELAXING THE TENSION IN THE DEEP VASCULAR APPARATUS, (especially of the brain,) allowing the blood to return to its old channels again in usual quantity if not increase, which would account for their invigorating effects. In sleeplessness, if hot salt water be poured down the spine for fifteen minutes at bed time, deep and refreshing sleep will follow it. The condition is result of LOSS OF TONE IN THE CEREBRAL CIRCULATION, with increase of vascularity as result; the

hot water is the needed stimulant. Chorea should be treated in similar manner.

The next chapter will be devoted to THE CIRCULATION OF THE BLOOD, to include RESPIRATION OR THE GREAT CARDIAC PULSATION and function of the SYMPATHETIC NERVE. As yet only the principles of anatomical construction, and the great physical law of atmospheric pressure force, operative in the circulation of the blood and animal juices, have had consideration; the particular circumstances of the various circulations having been intentionally left over for separate consideration. SPECIAL VASCULAR TERRITORIES under influence of individual nerves of the cerebro-spinal axis form a chapter of themselves, which the subject well deserves, whether viewed from a physiological or pathological standpoint.

Since BLOOD is the foundation of LIFE'S FORM, or body which is evolved out of it, and moreover its presence an absolute necessity for the generation of the vital phenomena, it follows as a corollary that full appreciation of the circulation is essential to a correct basis for scientific medicine. Medicine cannot become a science till this entire matter has full and complete solution. And to those who desire no change in its present status, it will be startling news, calculated to disturb somewhat, to have formal statement made, that Mr. Harvey's MODE FOR CARRYING ON THE CIRCULATION OF THE BLOOD AND JUICES IS NOT NATURE'S METHOD OF PERFORMING IT. When Mr. Harvey noticed that the great arterial and venous mains terminate in the heart, and the amount of muscular structure it contains, he formed opinion upon this data, that ITS MUSCULAR SUBSTANCE IS THE FORCE OF THE CIRCULATION; whereas, there are TWO GREAT FORCES which propel fluids through animal tissues, viz: MUSCULAR FORCE and ATMOSPHERIC PRESSURE FORCE. In the absence of atmospheric pressure the circulation of the blood could not go on. On the other hand, whilst muscular force is a great and essential power to the circulation of the blood, there is only but a SMALL FRAGMENT OF IT IN THE CENTRAL ORGAN, scarcely ONE PER CENT. of the muscular substance in the vascular apparatus having widest distribution over all this mechanism, a vast amount being used in the construction of the great heart of animal life itself, whose essential power upon the circulation is no longer subject of doubt. Vivisection settles it.

The difficulty in this old theory, which can perform nothing more, is not alone in its inadequacy for the LYMPHATIC CIRCULATION; nor in the ever-increasing difficulties arising in the



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Sep 14 1878

J. Collins Aug 11, 78.  
Librarian M.C.

Sir,

Enclosed find a copy of my paper  
present of a treatise on Physiology. It is  
designed more as a text book than as a book  
of reference, to indicate its character and  
scope, and prepare the way for presentation  
of a large amount of evidence "experimental" and  
"Medico-Clinical," in support of its views on  
human Medical subjects. The Comprehensive Character  
of the work - which more or less extends  
reference to equally important subjects: Medicine  
at least that which Man is very much engaged  
in life includes, every form and variety of  
human & could not well avoid reference to Physiology.

Yours at present engaged in a work upon  
the Circulation of the Blood & Lymph.



It will be a more logical and  
complete and conclusion of  
the propositions advanced in it as I can make it.

In this letter I could have occasion to make  
 special reference to occasional specimens contained  
 in your Medical Museum. Knowing what I know  
 upon this special matter I feel the arguments I shall  
 submit to the Congress will be reasonable. And  
 in this connection it would be well for me to  
 remember that an opinion which has no basis  
 in foundation is worth nothing. ~~But~~ As applied  
 to medicine the foundation must be anatomy and  
 physiology. In medicine I am sorry to find  
 so many superficial errors but I will not  
 dwell on that account. I intend to  
 correct some of them. I was not of course when  
 your letter arrived.

With Much Love

venous system, but grows more and more apparent out of essential circumstances in the ANATOMICAL CONSTRUCTION of the HEART AND ARTERIES—OF THE BLOOD ITSELF; and last, though not by any means least, THE RAPID VARIANCE OF INNUMERABLE LOCAL CIRCULATIONS, (diminishing or increasing every moment,) being an amount of opposing evidence which places the matter beyond question or doubt. How may CENTRAL FORCE provide for SECRETION; for EVOLUTION; for GENERATION; for THOUGHT FORCE; for SLEEPING; for WAKING; for ARREST OF HEMORRHAGE, etc.? Upon this amount of overwhelming anatomical and physiological data the statement is predicated, that BLOOD DOES NOT FLOW INTO A CENTRAL ENGINE to be driven PELL-MELL throughout the entire body. And this system of hæmal hydraulics, evolved out of the human intellect, must give place to the more intricate and higher order of vital mechanics to meet the requirements of Nature and of Medicine. There is an ALL-PERVADING AUTONOMY OF THE ARTERIES manipulating the arterial current and REGULATING THE CIRCULATION in a part under guidance of APPELLATE GANGLIONIC CENTRES of the sympathetic nerve, which have NERVE ARCS communicating with the SPINAL MEDULLA, and TERMINATING upon the SKIN SURFACE. And impression made upon the sentient nerves of the skin is REFLECTED UPON SPECIAL PORTIONS OF THE DEEP VASCULAR APPARATUS. That whilst the spinal medulla IS REFLEX CENTRE to voluntary or STRIATED muscular substance, it is as well the reflex centre to NON-STRIATED or involuntary muscular substance; and upon this circumstance hang all the THERAPEUSIS of EXTERNAL applications. Vital phenomena have similar regulation by INTERNAL agents furnished in Purgatives, Stimulants, Nervines, etc.

The great misfortune of Medicine has been that it has ever Lost Itself in the MINUTIA, and occupied itself in studying the details, over-taxing its mind with enormous number of circumstances, very interesting indeed, and necessary to a History of the nutritive process, and of a complete knowledge of Anatomy, and normal and pathological change; but nevertheless almost useless at the bedside, where only such knowledge is of service which has come of independent observation of diseased conditions, to be managed by that empirical procedure which experience had made out to be the best; the most satisfactory being the use of powerful sedatives and nar-

cotics for the relief of pain ; for which one had some right for self gratulation, having brought relief speedily about. The great embarrassment and confusion growing out of this anomalous state of things is mainly attributable to defective knowledge of the mode of the circulation of the blood, and the manner of its regulation or of its disturbance ; for out of these circumstances flow all vital phenomena. Medicine had been right all the time in its earnest conviction that life's problem must have solution upon an anatomical basis, adhering to it closely and persistently, with extraordinary painstaking of detail worthy of better success ; memorizing all the wonderful minutia of anatomy, and the colossal heap of independent clinical observations, with the theories evolved out of them by medical teachers. But it has never made physicians by this method ; on the contrary, the fact has long since become patent everywhere, that students must walk the hospital, and grow up by the bed-side in order to make good practitioners. Bringing theory down to practice seemed an impossible performance. And it is only since the introduction of physical law into the human body, for the elucidation of vital phenomena, that Medicine has made any solid advance, since this knowledge is of service at the bedside.

Chemistry and microscopy contribute important information from the excreta of deep-seated disorder. And tact in the use of auscultation and percussion, based upon the physical law of sound has been of incalculable service to physical diagnosis, receiving important additional aid through intelligent palpation and the use of exploratory puncture, especially by the aspiratory needle. The specula have also contributed important help, and must ever be regarded as valuable contributions to scientific medicine. But the latest, and by far the best of all, is the clinical thermometer ; of such ready application, and so unfailing in definite knowledge it imparts, of that most formidable factor of acute processes—TEMPERATURE, upon which circumstance treatment may have intelligent direction. It was a prodigious leap in the right direction, but it must be apparent to every one that a great hiatus still exists between medical knowledge and the practice of medicine, or the control and regulation of vital phenomena. And since every tissue and organ is constructed out of blood, and vital manifestations are evolved or have suspension altogether, according to whether it continue to circulate through a part or have arrest, it follows as a necessary corollary that Medicine must

learn the manner of the circulation, and methods of controlling it, if it desire to become more and more scientific and exact in its teachings, as also its success at the bedside. That whilst knowledge of regional anatomy is essential to physical diagnosis, and tact in physical diagnosis is essential in the practice of medicine; yet the question of questions that looms up above and overshadows all this is the essential nature of the lesion itself. for the true method of controlling inflammation can come only of such definite physiological knowledge of the blood circulation. Is the matter not one of great moment, if it prove true, to make statement that inflammation is a VASCULAR LESION, due to paresis of its muscular walls, from ganglionic disturbance in the part or organ? And if it may be shown that these vaso-motor ganglia connect with the spinal cord through nerve arcs communicating with the skin surface, as in the case of the striated muscular apparatus of the trunk, will it not amount to something in enabling Medicine to make near approach to an exact science, so close to the heart of every true son of this greatest of professions? The importance of the fact that respiration is a circulation and pulsation of the great heart of animal life, is ready explanation why increase of its movements necessarily hurries the central organ of the circulation, to pass on the blood torrent surging into this force-pump and reservoir, for distribution to the great nervous centres and all of life's domain. Increase of movement in the former must have corresponding augmentation in the latter; and increase of aspiratory force in the cardiac trunk has other important circumstance attending it, viz: Elevation of the body temperature from excessive importations of oxygen which the passing blood delivers over to the tissues. In the absence of infection or fermentative principle in the blood, increase of respiratory movement is the cause of fever. Fermentation is attended by the evolution of heat out of the body, with extension of the law into the vital mechanisms. But the persistence of fever after fermentation has been expended, is due to reflex action upon the spinal medulla of local congestions and inflammations set up by the fever, hurrying respiratory movement; and when the additional circumstance is borne in mind that the entire trunk is the analogue of a great artery, aspirating fluids into its great cavities, and expelling them again in rhythmic movement, through the constricting force of muscular substance under ganglionic control, the all-pervading principles of physical law may be seen to stand out in bold relief



against the great firmament of science, a faint picture of the unity and comprehensiveness of Nature.

What Medicine so badly needs is more knowledge of the laws controlling the universal scheme, and less of interminable minutia, the fitting analogue of which would be in naming every plank and brick and fastening in the construction of a house, calling each by distinct name, and filling vast tomes with all such details, instead of simply noting the chemical constitution and physical properties of the component parts and principles of architecture, upon which the temple has construction; all of which may be quickly taught and readily remembered, and put to practical use at a moment's notice. The former party spends days, months, years, in memorizing matters of no earthly use to him; on the contrary, crushes his intellect. It is too much the case in Medicine, mistaking this kind of industry, with capacity of memory, for Genius and Science. Medicine has pulled down the great temple of the human body, memorizing all of its pieces with a fidelity of detail which is extraordinary, going down into the minutia with the microscope, but losing sight altogether of the entity of the great macrocosm itself, and mode of construction of the temple built by the Great Artist of the Universe; thought having never projected a wave over the vastness of that comprehensive scheme, and made out the design or purpose in the shape of the body. From this high point of observation more of life's mysteries and of life's great expanse may be overlooked by the human intellect, and circumstances it could not make out before be looked through and through.

It is indisputable fact that Medicine ever advances upon an anatomical basis by application of physical law. It is the route Nature takes, and Medicine may not do more than follow after her footsteps, learning more and more of her laws and methods of procedure: And for the life of us we cannot make out why the human mind resists so stubbornly extension of physical law into the human body, for the elucidation and correct interpretation of vital phenomena: unless the explanation be in a fanaticism which is born of Egoism and Superstition—a religious monomania. Physical laws are God's laws, eternal and unchangeable, evolving life's form or constellation out of the material of the mother star, (the number being limited only by the supply of appropriate elements,) and moving in countless swarms and endless variety over the face of the huge planet which gives them birth, but are continually and perpet-



ually breaking in pieces to reform again. Considering the geological record, and the countless ages since life first came into the earth in its simplest form, with its final fruition in man, this kind of movement has been going on for considerable time.

AU REVOIR.

WASHINGTON, D. C., July 25, 1878.



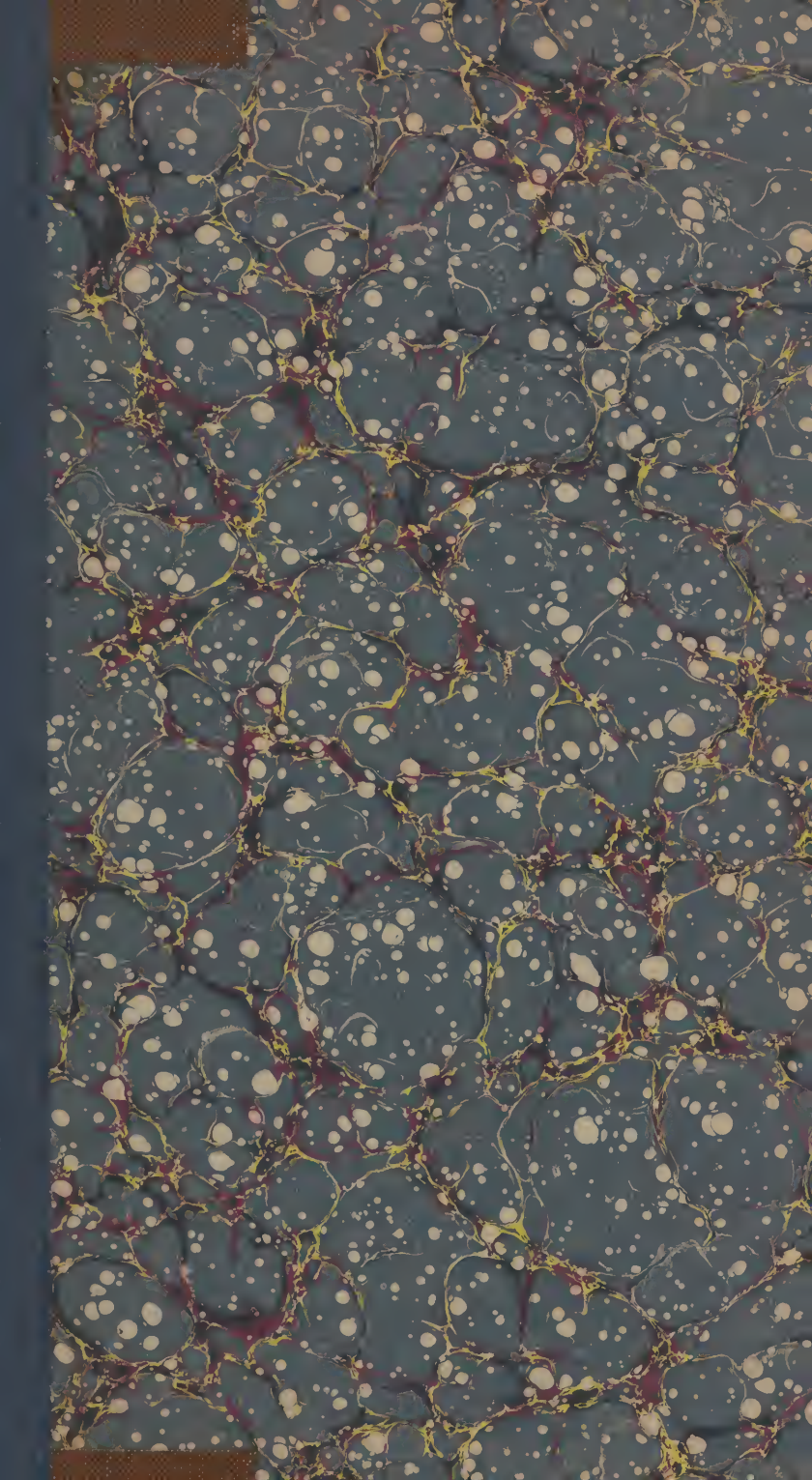












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